Vol. 106
No. 2740

Pages 1-22

July 4, 1947

Science

THE SCIENTISTS NEWSWEEKLY

A. Newton Richards, who succeeded Frank B. Jewett as president of the National Academy of Sciences, Washington, D. C., on July 1. Dr. Richards will continue his activities as vice-president in charge of Medical Affairs at the University of Pennsylvania, a post he has held since 1939. He has been professor of pharmacology at the University since 1910.

Published by the
AMERICAN
ASSOCIATION
FOR THE
ADVANCEMENT
OF SCIENCE

Importance of Ecology in the Training of Engineers

Paul B. Sears

Cathode-Ray Oscillograph

for Study of Electrical Phenomena

The DuMont Oscillograph transforms electrical energy into visible patterns for study and precise measurement.

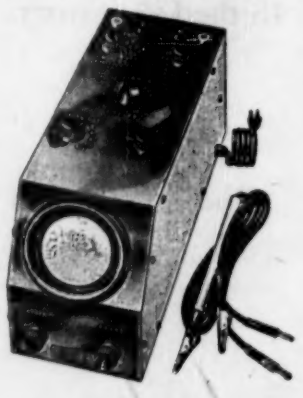
Applicable to analysis and research

Consistent with the policy of offering the latest in scientific instruments, Fisher Scientific Company presents the new DuMont Oscillograph—now available for general laboratory use.

The DuMont Oscillograph, a large and versatile adaptation of the five-inch cathode-ray tube instrument, is being employed for such diverse uses as: Pictorial presentation of electrical reactions of human nerves—Comparison and study of magnetic properties of ferrous metals—Research work in ultrasonics—Analysis of petroleum products under internal combustion mechanics . . . and many other varied problems.

The DuMont Oscillograph is self-contained, portable and is guaranteed for one year. It is available complete with operating instructions and guidebook from Fisher stock at $111.50.

The new Waterman Pocketscope is a small oscilloscope with a two-inch cathode-ray tube. It is especially valuable for use as an electrical "trouble-shooting" instrument. It can be used in cramped quarters, under brilliant lights or on the floor as well as on the bench; it costs $66.00.



The Pocketscope is a complete, portable, small size oscilloscope.

Manufacturers—Distributors

FISHER SCIENTIFIC CO. 717 Forbes St., **Pittsburgh (19), Pa.** 2109 Locust St., **St. Louis (3), Mo.**

EIMER AND AMEND Greenwich and Morton Streets **New York (14), New York**

Headquarters for Laboratory Supplies

Importance of Ecology in the Training of Engineers

Paul B. Sears
Oberlin College, Oberlin, Ohio

I SHALL BEGIN WITH THE STATEMENT OF several propositions:

(1) Engineers and those who direct their activities now play a great, if not a preponderant, part in shaping the daily activities and thus the general pattern of American life.

(2) The fundamental and inescapable basis of human culture lies in its relation to the means of subsistence—the maintenance of soil, the conservation of water through agriculture and the related arts which apply biology.

(3) Engineering activities profoundly affect the material and energy cycle upon which civilization rests.

(4) Engineering students, along with those preparing for the practice of medicine, rank among the groups having the highest intelligence in American colleges and universities.

(5) Current and accepted practice in the training of engineers affords practically no opportunity to learn the fundamentals of biological science.

The means of subsistence and much of the essential energy and raw materials needed by the people of the United States depend upon the order and balance of the landscape. The fixation of carbon by green plants, which is the fundamental process in living nature, depends upon the maintenance and improvement of soil and the conservation of moisture for its efficiency. Technological activities which interfere with these processes run counter to the general welfare in that respect, introducing factors which are just as essential to good engineering practice as a knowledge of dynamics, design, or materials.

The problem can be exemplified as follows:

Highway construction. This operation involves drainage, usually designed with but one end in view: to keep water from the crown of the highway and move it away as rapidly as possible. The aggregate area of highway appears to be about 1 per cent of the national area. If this meant a reduction of only 1 per cent in the moisture available for agriculture, it would not be serious. But our highway system drains much of the adjacent land and constitutes a rectilinear system of general drainage, supplanting the natural curvilinear system of stream tributaries.

This superposed drainage pattern has two serious consequences. It accelerates movement of water into main drainage channels in flood time and interferes with maintenance of ground-water level by removing water before it can soak in. Also, by speeding the movement of water in earth channels, it leads to roadside erosion and consequent lateral gullies into agricultural land. These problems are most serious on locally built and maintained roads—the so-called county laterals. In one group of counties studied, the average county road level had been lowered three feet in 40 years and was responsible, in large part, for an average of 10 gullies to the mile in adjacent farm land. The total mileage of such local roads is many times that of main highways.

Stream sanitation. Neglecting the amenities to which streams and ponds contribute, the potential food production from clean inland waters is about equal to that of good average farm land, acre for acre, and increases up to a limit with increase in depth. Millions of dollars are spent annually in the stocking of inland waters in the United States, but this money is largely wasted and an important food resource rendered useless by industrial waste and urban sewerage. While this tremendous and tangible loss can be attributed to social and economic faults, it actually stems from defective ideals of industrial and municipal engineering design. Such designs are not technically complete unless they reckon with the disposal of waste in a manner that will not produce economic loss and damage to other property, public or private. In the Miami River, in August 1946, over 200,000 fish were killed by the toxic wastes of one industrial plant, for example.

Stream control. This has as its primary objective the lessening or prevention of flood damage, but the conservation of water for public use and navigation is scarcely less important. Apart from increased use due to greater population density, the per capita requirements for water are steadily increasing with technological advances and improved living standards. The hydrology of a stream extends to the limits of its drainage basin, and fundamental hydraulics needs to reckon with the impact of raindrops as well as the phenomena of large volumes of water. The point of view with which the ecologist approaches water relations is as essential to stream control as the conventional approach of the engineer and must be incorporated into engineering techniques to make them effective. The fact that an ecological approach has been used in such projects as the Tennessee Valley Authority and the Muskingum Watershed Conservancy District is likely to cause overoptimism. One dam, built since 1935 at a cost of over $20,000,000, was completed without attention to ecological factors. In fact, the suggestion

Presentation before the Symposium on Applied Ecology of the Ecological Society of America, AAAS Boston Meeting, December 28, 1946.

that the valley be regarded as a unit and attention be given to soil and drainage conditions upstream was vigorously rejected. Within a few years after completion, the dam had intensified flood damage, and the reservoir behind it was silting rapidly, leading to a frantic demand for improved land use upstream. Sound engineering design would have reckoned with these hazards in the first place, in addition to those recognized by custom as engineering problems.

Turning now to the curricula in engineering schools, those of 10 leading institutions, with enrollments from 2,100 to 4,900, are of interest. In none of them does the generalized first-year course call for, or even allow, any biological instruction, nor is any provided for in any of the subsequent specialized years, with the exceptions to be noted. The normal courses in civil engineering usually include water supply and sewerage engineering, but for these the prerequisite is hydraulics only. In one school engineers may take forestry and conservation among their 15 hours of electives. The two other schools offering such courses appear to limit them to agricultural engineers, and even if they did not, the usual practice with electives for engineers is to confine them to strictly professional subjects. In three instances courses in soil mechanics are provided, but it appears from the descriptions that none of these goes beyond the promise of its title in giving an understanding of soil fundamentals. Thus, it is either difficult or impossible at present for civil engineering students to have contact with a field vitally related to their work. This is even more true of engineers, chemical, mechanical, and electrical, who will be expected to design industrial plants.

Two special fields of engineering involve biology explicitly. The first is agricultural engineering, the second in its fullest flowering is known as biological engineering. Agricultural engineers vary in training from civil engineers with courses in agronomy and animal husbandry (no basic biology and no ecology) to agricultural majors with sufficient engineering electives to qualify them. The latter may or may not have had ecological training—generally not. From observation I would say that much of the success of graduate agricultural engineers depends upon their boyhood experience with soil, water, growing crops, and domestic animals. They are at least aware of certain phases of reality which to the city-bred graduate engineer are a closed book.

Biological engineering, as exemplified in one of the 10 institutions, is slanted toward industrial production of biological materials and includes adequate training for certain types of biological research, fundamental in character but wholly remote from environmental studies—that is, ecology. From this high point it grades down to sanitary and water supply engineering which, as we have noted, is innocent of fundamental biological discipline.

In only one of the institutions under discussion is a course in ecology available, and then outside the pale of engineering education. In three of the schools, courses conservation are offered to, and, it is to be hoped, elect by, engineers.

These matters concern the self-interest of the engine ing profession no less than the interest of the public. 1936–37 the head of an engineering school was great concerned because he could not place his graduates civil engineering. Yet there was at that time an acu shortage of technicians to serve the numerous soil co servation districts then being organized. If these grad ates had had the slightest knowledge of soil and vege tion, they would have been in demand. At his request special course was organized in one of the biologic departments of his university. One engineer attended t first meeting of this class—a graduate assistant who w sent over to learn the ropes, in full confidence that h could pass on any necessary information to young eng neering students by sandwiching it in between real important matters. When the situation was brought b fore the director, he explained that required courses engineering left no time for anything else, and that h school would lose its rating if he interfered with custo In view of this, his original proposal was puzzling, to s the least.

Recently one of the engineering officials of a maj American corporation, speaking before the alumni cou cil of an excellent technical school, said bluntly that fro his experience he would rather have engineers trained the liberal arts atmosphere of a small college, which h named, than the crack professionals from this technic school. He went on to say that the men with a liberal ar background were more resourceful, more flexible, an more imaginative in their approach, all of which mo than compensated for their lack of specialized technic courses. It was his opinion that, with a proper foundatio these specialties could be picked up on the job. What ha been lost through lack of broad training could not. I my observation, one of the things least likely to be a quired without some measure of formal training is a co prehension of broad biological principles.

The biological profession is not without responsibilit for the situation which has been described. In its gener courses it has ridden evolution to death, emphasizin technicalities of structure and function while neglectin the great framework of life and environment which giv these technicalities their significance. Many such cours are geared frankly to the supposed needs of future pro fessional biologists. They would ill serve the needs engineers who took them. And, assuming that ecology offered (which is not yet the case in many institutions higher learning), these formalized courses in beginnin biology constitute a *cheval-de-frise* that must be encou tered first.

Biological science has much to offer that is of extrem importance to the engineer and to the future layman a well. I suspect that such material is of no less importanc

as an introduction to the professional study of biology. It is perfectly possible to teach a respectable introductory course so that no future engineer who takes it will thereafter be blind to the broad biological consequences of his professional work. But until such a reform in emphasis and arrangement comes from our side of the fence we are in a poor position to urge that the fence be let down.

At a higher level of instruction, it will be a great contribution if we can overhaul our courses in ecology, building them squarely into the structure of the other natural sciences. The possibility of this was suggested long ago by Henderson in his *Fitness of the environment*. It has been carried beyond the point of suggestion by both Jenny and Nikiforoff in their studies of soil energetics and has been considered by Transeau in relation to vegetation. Unquestionably, much more research is needed on such problems as the energy patterns of plant communities and drainage systems. But the basic means exist for organizing what we know so that it will carry its influence down to the elementary level in biology. Once this is done, that influence may extend across boundaries of knowledge to command the professional respect and serve the needs of that magnificently disciplined group of our colleagues, the engineers.

Meanwhile there is the possibility that those who train engineers may take some initiative in the matter. It is encouraging to note that The Ohio State University, along with several other institutions, is inaugurating an optional five-year engineering course in the hope that it will result in broader training. I do not envy the dean who attempts seriously to liberalize the present tight curricula. It will take courage to follow the course of reform in medical schools; it will take even more to avoid the pitfalls which have at times defeated the intent of premedical liberal education. I predict, however, that the first good engineering school to grapple boldly with the problem will acquire such prestige that other institutions will hasten to follow its example. It is generally true that the schools with the highest standards have the longest and best waiting list.

Shift of Employment Among Younger Scientists

M. H. Trytten, *Director*

Office of Scientific Personnel, National Research Council, Washington, D. C.

SCIENTIFIC PERSONNEL HAS PROBABLY never experienced the situation now existing with respect to demand. The unprecedented enrollment in institutions of higher education and the great expansion in scientific work generally have resulted in extraordinary recruitment efforts by employers. Evidence of unusual shifting of employment by scientists has been apparent. In particular, the less fortunately situated higher educational institutions have complained of the difficulty of recruiting and maintaining faculties in the sciences. The implications of rapid shifting are clear enough to require no elaboration. The smaller institutions do train a very large proportion of the higher-education population. Should much shifting occur, it would seem likely that properly qualified instructors would become unavailable for a significantly large part of the students in colleges and universities.

To secure some measure of this trend, the Office of Scientific Personnel of the National Research Council has polled a sample of those receiving doctoral degrees in the sciences in the years 1936–45, inclusive. The survey was confined to 13 disciplines in which the maximum competition for personnel among educational institutions was expected. About 10 per cent of the total number was selected as a sample, with slightly higher numbers in some disciplines. The survey was confined to the years stated, since the future of the sciences lies largely in the hands of the younger men. This does not mean that older scientists are not shifting. But especial importance seems to attach to the distribution of those who must be the leaders of science in the near future. Although replies are arriving daily, the present study includes only approximately the first two-thirds to reply. A rough check of perhaps 200 later replies does not alter the results significantly.

One interesting fact is that almost 10 per cent of the questionnaires were returned without forwarding addresses. Since the original addresses were in practically all cases relatively recent, the implication is that most of these individuals had shifted employment. Thus, figures on shifts in employment given below must be corrected upwards by a figure of 9 per cent or less, depending on the interpretation of the lack of proper address.

Table 1 shows the shifting occurring within the past 12 months among the first 975 scientists replying to the questionnaire. It will be seen that 248, or 25.4 per cent, have actually changed employment. The greatest shifting is within education. Here, 92, or about 10 per cent, of the younger scientists have changed jobs. Most of these have found more favorable employment in some other educational institution, although 26 have left the field of education. The Government has lost about 80 scientists, most of these going, presumably, to the universities and colleges. Much of this probably occurred

early in the year, when wartime researches were terminating.

The survey also elicited information on firm commitments to shift employment. Although Table 1 shows that 248 younger scientists have changed employment, there

year ago, if our sample is a valid indication. There seem little reason to doubt its fairness.

The question was asked as to whether the responden was now contemplating or seeking a change. About 2 per cent of those not covered above replied in the a

TABLE 1

PRESENT-DAY SHIFTING OF SCIENTISTS AWARDED PH.D. DEGREES DURING THE DECADE 1936–45, INCLUSIVE

Changed within the last year:	Agriculture	Bacteriology & microbiology	Biochemistry	Botany	Chemistry	Engineering	Entomology	Geology	Mathematics	Physics	Physiology	Psychology	Zoology	Totals	Per cent
From Federal Gov't to Education	3	2	2	4	8	3	2	4	5	5	6	7	1	52	5.1
" " " " Industry	2	2	2	1	2	1	1	0	3	1	1	0	1	17	1.7
" " " " State Gov't	0	0	1	0	0	0	1	0	0	1	0	1	1	5	.5
" " " " Federal Gov't	0	1	2	1	0	0	0	0	0	2	0	4	1	11	1.1
" " " " School or Military	0	1	0	0	0	0	1	0	0	0	0	0	2	4	.4
From State Gov't to Education	0	0	0	1	0	0	1	0	0	0	0	0	0	2	.2
" " " " Industry	0	0	0	0	0	0	0	0	0	0	0	1	0	1	.1
" " " " State Gov't	0	0	0	0	0	0	0	0	0	0	0	1	0	1	.1
" " " " Federal Gov't	1	0	0	0	0	0	0	0	0	0	0	0	1	2	.2
" " " " School	0	0	0	0	0	0	0	0	1	0	0	0	0	1	.1
From Industry to Education	0	0	2	1	2	2	0	3	3	5	1	3	0	22	2.2
" " " Industry	1	2	2	1	7	4	1	4	0	4	1	2	0	29	2.9
" " " State Gov't	0	0	0	0	0	0	0	0	0	0	0	0	0	0	—
" " " Federal Gov't	0	1	2	0	1	0	0	0	1	3	0	0	0	8	.8
" " " School or Military	0	0	0	0	0	0	0	0	0	1	0	0	0	1	.1
From Education to Education	3	2	8	6	4	2	5	2	9	6	5	6	8	66	6.6
" " " Industry	0	2	2	0	2	3	1	0	0	0	2	1	1	14	1.4
" " " State Gov't	0	0	0	0	0	0	1	0	0	0	0	0	0	1	.1
" " " Federal Gov't	1	2	1	0	1	1	0	0	1	0	0	3	0	10	1.0
" " " School	0	0	1	0	0	0	0	0	0	0	0	0	0	1	.1
Totals	11	15	25	15	27	16	14	13	23	28	16	29	16	248	25.4

Total number of questionnaires sent: 1,600; total number of replies received: 975; questionnaires returned—forwarding addresses unknown: 91; unemployed: 17; per cent known to have changed within last year: 25.4.

are, in addition, 135 younger scientists who have positive commitments to change, either by accepting new positions or by signing contracts. There are significant differences in the nature of these expected shifts. The shifts from the Federal Government are proportionately much less, accounting for only 20 per cent of the shifts, whereas the shifts from the Federal Government in Table 1 account for 36 per cent. In education, however, the shifting is heavy. Almost 60 per cent of the expected shifts occur either from educational institution to educational institution or out of education to industry and the Government. Shifts from one educational institution to another account for 66 out of 92 of these shifts.

Thus, 383 shifts in employment among 975 younger scientists have occurred recently or will take place shortly. (A scientist shifting twice in this period is counted but once.) This is over 39 per cent. Adding to this a conservative 5 per cent from those whose addresses are unknown, it is safe to say that nearly 45 per cent of the scientists in this age group have changed or will change employment in an 18-month period beginning about a

firmative, and the proposed nature of the change wa indicated in a few cases. If these changes eventuate, th total changes will approach the two-thirds mark. How ever, the likelihood of changes in all these cases is no determinable.

The total picture, however, is certainly indicative of a abnormal condition which has serious implications. This information has been furnished to the President's Scientific Research Board, which will discuss the phenomenon together with other information in the report on scientific personnel.

Table 2 is a tabulation of the returns to give an indication of the employment of these younger scientists. It should be noted in particular that industry and the Federal Government employ almost half of this group. The decreasing incidence of scientists in the military services is interesting.

Table 3 shows the activity of the younger scientists. Particularly noteworthy is the fact that while Table 2 shows that education employs more than the Federal Government and industry together, Table 3 indicates

that many more scientists list research, rather than teaching, as their activity. The totals in this column are not exclusive, but there seems reason to believe that a significant number listed as employed by educational insti-

TABLE 2

DISTRIBUTION OF EMPLOYMENT OF SCIENTISTS EARNING PH.D. DEGREES DURING THE DECADE 1936–45, INCLUSIVE

Employment	Full and part-time employment*					
	Federal Gov't	State Gov't	Industry	Education	Military†	Unemployed‡
May 1, 1946	137	52	305	472	36	13
%	13.5	5.1	30.0	46.5	3.6	1.3
May 1, 1947	114	52	309	520	3	17
%	11.2	5.1	30.4	51.2	.3	1.6
Near future§	105	43	326	526	4	17
%	10.3	4.2	32.0	51.5	.4	1.7
Future‖	104	43	323	532	4	17
%	10.2	4.1	31.6	52.0	.4	1.7

* About 40 individuals are working in more than one category.
† Military men not counted in Federal Government column.
‡ Returned to school: 13; women who have married: 4.
§ Assuming present commitments are fulfilled and "definite offers likely to result in change of employment" are accepted.
‖ Assuming changes are made for which desire is expressed.

tutions are actually spending full time on subsidized research. It seems probable that some of the recent shifting is toward contract research.

In a report to the President, "A Program for National Security," by the Advisory Commission on Universal Military Training, figures are given for expenditures in 1947 for research as differentiated from development (p. 179). The figure in the Government, in universities,

TABLE 3

TYPES OF WORK BEING DONE BY PH.D. SCIENTISTS

	Agriculture	Bacteriology & microbiology	Biochemistry	Botany	Chemistry	Engineering	Entomology	Geology	Mathematics	Physics	Physiology	Psychology	Zoology	Totals	Per cent
Part or full-time teaching	27	17	26	35	36	39	26	21	53	45	32	42	60	459	38.0
Part or full-time research	46	40	52	25	109	48	38	26	18	81	29	31	31	574	45.7
Part or full-time administration	14	14	12	4	30	30	9	20	8	13	9	14	7	184	14.6
Unemployed*	1	1	2	0	2	0	3	1	2	1	1	1	2	17	1.4
Military	0	1	0	0	0	0	0	0	0	1	1	0	0	3	0.3

* Returned to school: 13; women who have married: 4.

and in industry is about $335,000,000. This is probably about five times the rate of expenditure in 1937, since this is the ratio of expenditure for research and development in 1947 and in 1932. The resulting personnel demand accounts for the present unprecedented situation in employment. It seems obvious that careful thought is needed to insure that the stresses resulting from this situation do not militate against the soundness of scientific development.

Financial Reports of the AAAS for 1945

F. R. Moulton, *Administrative Secretary*

THE FINANCIAL STATEMENTS OF THE Association which follow are condensations of the audited reports by G. P. Graham & Company, certified public accountants, for the calendar year 1945. During the war period it was not possible to obtain prompt audits of the Association's accounts. Audited reports for the calendar year 1946 are expected within a few months.

For many years the records of the finances of the Association have been kept in two almost completely independent accounts, that of the Treasurer and that of the Administrative Offices. The former includes all the permanent funds, such as those the income from which may be used only in support of research, those given for providing emeritus memberships, and those awarded as prizes for meritorious scientific work. The latter includes all receipts, expenditures, and balances incident to the operations of the Association, such as dues from members, expense of the offices, holding meetings, etc.

Treasurer's Accounts

The following statement of receipts and disbursements describes the financial transactions of the office of the Treasurer during the calendar year 1945; the balance sheet, the condition of the Treasurer's accounts at the close of the year, December 31, 1945.

Statement of Receipts and Disbursements

Receipts

Interest and dividends received	$ 3,514.09
Contributions in support of research	400.00
Life membership fees	4,900.00
Grant for research returned	91.05
George Westinghouse Science Writing Award Fund	7,500.00
Sale and redemption of securities	111,290.54
Total initial cash and receipts	$127,695.68

Disbursements

Grants in aid of research	$ 1,486.00
Journal subscriptions (life members, etc.)	1,743.00
Emeritus life membership fees	1,500.00
Miscellaneous items	70.57
Securities purchased	120,051.60
Total disbursements	$124,851.17
Excess of receipts over disbursements	$ 2,844.51

Balance Sheet as of December 31, 1945

Assets

Cash	$ 38,132.4
Due from Administrative Office (building fund, etc.)	49,204.3
Securities in portfolio	249,711.8
Accrued interest and dividends	883.7
Total assets (Treasurer's Account)	$337,932.3

Liabilities

Endowment and restricted funds	$175,491.1
Building fund*	48,602.5
Funds for general purposes	49,747.6
Current (Academy grants, prize funds, etc.)	13,136.9
Reserve funds	38,740.7
Accumulated income	12,213.2
Total liabilities (Treasurer's Account)	$337,932.3

* Building fund was used, in part, for purchase of property at 1515 Massachusetts Avenue, Washington 5. D.C.

Administrative Offices Accounts

The corresponding statements of receipts and disbursements of the Administrative Offices of the Association for the calendar year 1945 are as follows:

Receipts

Dues from members	$128,200.0
Interest on bank accounts	143.9
Journal subscriptions for life members, etc.	1,743.0
Sale of Summarized Proceedings, etc.	64.4
Total receipts	$130,151.3

Disbursements

Salaries of office employees	$ 34,286.51
Postage, printing, office supplies, etc.	6,334.67
Executive Committee	1,574.69
General Secretary's office	317.96
Printing and mailing *AAAS Bulletin*	3,756.67
Circularization for members	2,517.02
Allowances to Pacific and Southwestern Divisions	3,604.00
Secretaries' conferences	597.88
Section expenses	311.84
Net disbursements for journals	23,970.78
Total expenditures	$ 77,272.02
Excess of receipts over expenditures	$ 52,879.36

NEWS *and Notes*

Frank T. Gucker, Jr., Department of Chemistry, Northwestern University, has been appointed chairman, Department of Chemistry, Indiana University, succeeding **Ralph L. Shriner,** recently appointed head of the Organic Division, Department of Chemistry, State University of Iowa. Dr. Gucker will assume his new duties September 1.

H. J. **Stafseth,** professor of pathogenic bacteriology, Michigan State College, has been appointed head, Department of Bacteriology and Public Health, and director of Biological Sciences. Prof. Stafseth has recently returned from China, where he served as a technical adviser to the Chinese Ministry of Agriculture.

Arthur H. Graves, curator of Public Instruction, Brooklyn Botanic Garden, retired July 1 after 26 years of service. Dr. Graves will continue researches, begun in 1910, on a deadly fungus disease of the American chestnut tree.

William V. Houston, president of Rice Institute, and **Ralph P. Agnew,** chairman, Department of Mathematics, Cornell University, will be visiting professors at Case Institute of Technology during the summer session. Dr. Houston will lecture and consult on research problems, as well as carry on his own investigation in quantum mechanics. Prof. Agnew will teach a course in Infinite Series and Summability. The visiting professorships are made possible by a grant from the Cleveland Foundation.

D. **W. Thorne,** associate professor of agronomy, Utah State Agricultural College, has been appointed to succeed **R. J. Evans,** head of the Department of Agronomy since 1930, who retired on July 1.

Frederick Wyatt, chief psychologist, McLean Hospital, Waverley, Massachusetts, has been appointed associate professor (affiliate), Department of Psychology, Clark University. Dr. Wyatt will take part in the training program in clinical psychology and will also continue his work at the McLean Hospital.

William von Fischer, a member of the Department of Chemistry, Case School of Applied Science, since 1935, has been promoted to professor of chemistry.

Robert B. Woodward, associate professor of chemistry, Harvard University, has announced the first synthesis of substances with general molecular structural characteristics identical with those of fibrous proteins. The synthesis, the closest man-made substance to nature-made proteins, introduces an entirely new class of synthetic materials from which useful fibers and transparent films can be made.

M. C. Kik, associate professor of agricultural chemistry, College of Agriculture, University of Arkansas, has been decorated by the Government of the Netherlands in appreciation for services rendered during and after the war. Prof. Kik has been made an officer in the Order of Orange-Nassau.

Ezra T. Cresson, Jr., associate curator, Department of Insects, Academy of Natural Sciences of Philadelphia, resigned July 1 after 39 years of service. The Board of Trustees of the Academy has designated him a Research Fellow of the institution.

F. H. Spedding, director, Institute for Atomic Research at Iowa State College, has been elected associate chairman of the Board of Governors of the Argonne National Laboratory.

C. N. Hugh Long, Sterling professor of physiological chemistry, Yale University, has been appointed dean, School of Medicine, succeeding **Francis G. Blake.**

Herbert A. McCullough, Bessie Tift College, Forsyth, Georgia, has been appointed associate professor of botany, Howard College, Birmingham, Alabama.

Ira H. Cram, geologist, Pure Oil Company, Chicago, and past-president, American Association of Petroleum Geologists, gave the annual petroleum geology lectures at the University of Michigan, May 1 and 2.

Andrew Ellicott Douglass, director emeritus, Steward Observatory, and professor of astronomy and dendrochronology, University of Arizona, was recently honored at a dinner given in observance of his approaching 80th birthday. At that time, a group of his colleagues and associates presented to the University a bronze plaque to mark the extensive State Museum exhibit of Dr. Douglass' researches in climatology and dendrochronology.

John L. Bray, head, School of Chemical and Metallurgical Engineering, Purdue University, since 1935, will retire September 1, and will be succeeded by **R. Norris Shreve,** professor of chemical engineering. Dr. Bray will continue as professor of metallurgical engineering.

M. A. Basoco, Department of Mathematics and Astronomy, University of Nebraska, has been appointed chairman of that Department, succeeding **Ralph Hull,** who will resign August 31 to become mathematician in the Physical Research Unit, Boeing Aircraft Company, Seattle, Washington.

David L. Thomson, dean, Faculty of Graduate Studies and Research, McGill University, has been appointed Gilman Cheney professor of biochemistry, succeeding **J. B. Collip,** who has resigned to become dean, Faculty of Medicine, University of Western Ontario.

Otto Storch, after much suffering under the Nazi regime in Austria, has recently been appointed director of the Zoological Institute, University of Vienna, according to word received from Paul Weiss, University of Chicago. Prof. Storch would greatly appreciate receiving from American zoologists reprints of their articles published since 1940.

Grants and Awards

Grants-in-aid to enable 47 outstanding scientists to attend the 6th International Congress for Experimental Cytology, meeting in Stockholm, July 10–17, were announced by UNESCO June 20. Recipients from the United States include: F. Nord, professor of chemistry, Fordham University, New York City; S. Speigelman, Washington University School of Medicine, St. Louis, Missouri; and Paul Weiss, professor of zoology, University of Chicago.

A. Remington Kellogg, curator, Division of Mammals, U. S. National

Museum, was the recipient of the University of Kansas Alumni Association Award for Distinguished Service, June 16.

Rufus A. Lyman, founder and editor, *The American Journal of Pharmaceutical Education*, and retired dean, Pharmacy College, University of Nebraska, was recently awarded the Remington Medal for outstanding work in pharmacy, presented by the American Pharmaceutical Association.

Harry A. Waisman, formerly research associate, Department of Biochemistry, University of Wisconsin, received the Borden Award for Research in Medicine at the University of Wisconsin. The award is given annually to the senior medical student who has completed the most research while in medical school.

Summer Programs

The University of Nebraska Laboratory of Anthropology will be field headquarters for the Missouri River Basin Archaeological Program for 1947, which was started early in June. The program is under the direction of the Smithsonian Institution, in cooperation with the Bureau of Reclamation, the Corps of Engineers, the National Park Service, and local institutions in the 10-state basin area. The work this summer, which will consist of continued surveys and some test excavations at about 33 sites of multipurpose dams and reservoirs having a "high priority" in the Missouri River Basin flood control and reclamation program, will be directed by Waldo R. Wedel, Wesley L. Bliss, Joseph Bauxar, Paul Cooper, John Hughes, and Marvin Kivett, archaeologists, and Theodore White, paleontologist.

Union College, Schenectady, New York, has awarded 50 six-week, all-expense General Electric Science Fellowships for summer study to high school science teachers in eight northeastern states. The 17 women and 33 men will be taught the theory behind scientific discoveries made during the war years in physics and chemistry and will witness these discoveries in actual use through visits to modern industrial laboratories.

The fellowship program, now in its third year, also emphasizes development of new techniques for teaching scientific concepts. Fellows will study under the college faculties of physics and chemistry. Nine members of the General Electric Company laboratory and engineering staffs will assist in presentation of the course and demonstrations.

Meetings

The Annual Symposium of the Society for the Study of Development and Growth will be held at the University of Connecticut, Storrs, August 26–29. The program will include papers by Alexandre Rothen, Rockefeller Institute for Medical Research, on "Long-Range Forces Between Macromolecules"; Robley C. Williams, University of Michigan, "Electron Microscopy in Biology"; Jacques Monod, Pasteur Institute, Paris, "Enzymatic Adaptation and Its Bearing on Problems of Cell Physiology, Genetics, and Differentiation"; Tracy M. Sonneborn, Indiana University, "Mechanisms Determining Persistent Intraclonal Diversities in Paramecium"; Jean Brachet, University of Brussels, Belgium, "Biochemical and Physiological Interrelations Between Nucleus and Cytoplasm"; Armin C. Braun, Rockefeller Institute for Medical Research, "The Physiology of Tumor Inception in Crown Gall Disease of Plants"; Alexander Haddow, Chester Beatty Research Institute, Royal Cancer Hospital, London, "The Mode of Action of Chemical Carcinogens, and Its Possible Relation to the Origin of Viruses"; and Hermann Lisco, University of Chicago, "The Relation of Atomic Energy to the Pathology of Growth and Development." Further information may be obtained from Walter Landauer, University of Connecticut, Storrs, Connecticut.

The New England Association of Chemistry Teachers extends a cordial invitation to teachers of science to attend the 9th Summer Conference at Wellesley College, August 18–23. The program features two symposia, one on Development of Atomic Structure, under the chairmanship of Alfred S. Brown, Colgate University, and another on Selected Topics From Introductory Chemistry, with Hubert N. Alyea, Princeton University, as chairman. Other papers to be presented include: "Science Fights in the Front Lines," Charles E. Waring, University of Connecticut; "New Chemical Processes of Interest to Chemistry Teachers," Emil R. Riegel, University of Buffalo; "The College Board Examinations," William W. Turnbull, CEEB; "European Problems," Samuel Van Valkenburg, Clark University; "Metal Hydrides," representative of Metal Hydrides, Inc.; "Minerals, Fun and Profit," John B. Lucke, University of Connecticut; "Role of Chemistry in the Treatment of Modern Textiles," Donald H. Powers, Monsanto Chemical Company; "*Drench* and Fire Control," Mr. Parker, Arnold, Hoffman & Company; "Crystal Structure," Charles Stillwell, Dennison Manufacturing Company; "Fluorine and Tooth Decay," Joseph F. Volker, Tufts College Dental School; "Acetyl Derivatives of 3,5-Dichlorosulfanilamide," Margaret K. Seikel, Wellesley College; "Commercial Production of Fluorine and Its New Uses," John T. Pinkston, Harshaw Chemical Company; "Flight Over Bikini," Royal M. Frye, Boston University; "Recent Developments in Powder Metallurgy," Alden M. Burghardt, Watertown Arsenal; and "Glass for Science" (motion picture), representative of Corning Glass Works.

Information concerning registration and accommodations can be obtained from the registrar of the Summer Conference Committee: Pearle R. Putnam, Dean Academy and Junior College, Franklin, Massachusetts.

Elections

The Kansas Academy of Science elected the following officers for 1947–48 at its annual meeting at Lawrence, Kansas: J. C. Peterson, Kansas State College, president; F. W. Albertson, Ft. Hays Kansas State College, president-elect; Paul G. Murphy, Kansas State Teachers College, Pittsburg, vice-president; F. C. Gates, Kansas State College, secretary; S. V. Dalton, Ft. Hays Kansas State College, treasurer; A. B. Leonard, University of Kansas, P. S. Albright, University of Wichita, and A. C. Carpenter, Ottawa, Executive Council members; D. J. Ameel, Kansas State College, librarian; Robert Taft, University of Kansas, editor of *Transactions;* W. H. Schoewe, University of Kansas, associate editor, geology; and F. C. Gates, Kansas State College, associate editor, botany.

The 79th annual meeting was presided over by Claude W. Hibbard, who also gave the retiring presidential address on "Pleistocene Vertebrate Faunas of Kansas." A public address was given by Waldo Wedel, U. S. National Museum, on "Prehistory and the Missouri Basin Development Program (see Summer Programs, *News and Notes*).

The Academy is scheduled to meet at Pittsburg, Kansas, in 1948; at Manhattan, Kansas, in 1949; and at Wichita, Kansas, in 1950.

The Chicago Academy of Sciences, at its 90th annual meeting, May 12, elected the following officers for the coming year: Nathan Smith Davis, president; William F. Henderson, first vice-president; Leslie Brainerd Arey, second vice-president; Hulburd Johnston, secretary; Herbert Edwin Bradley and Louis Ellsworth Laflin, Jr., new trustees; and William E. Powers, scientific governor.

NRC News

Fellowships and Senior Fellowships in Cancer Research, supported by the American Cancer Society and administered for the Society by the Committee on Growth of the NRC, are offered for advanced training and experience in any field of investigation pertaining to the problem of cancer, including the various biological, chemical, and physical sciences and clinical investigative medicine. Senior Fellowships are intended for men or women who already have demonstrated unusual competence in research and are designed to provide an opportunity for a prolonged period of advanced training in the field of growth. Their tenure ordinarily is three years. In occasional instances, predoctoral fellowships also have been awarded.

Twenty-four fellowships have been awarded for the year 1947–48, and five have been renewed. In addition, four fellows, awarded Senior Fellowships during 1946, will be serving their second year during 1947–48. The recipients are:

Christian B. Anfinsen, Jr., Boston, Massachusetts, to work on protein synthesis in normal and pathological tissues at the Medical Nobel Institute, Stockholm, Sweden (Senior Fellowship).

Narcisse R. Bothereau, South Pasadena, California, to work on the problem of the early diagnosis of cancer at the University of California Medical School, San Francisco.

Joseph H. Burchenal, Milford, Delaware, to work on new methods in the chemotherapy of cancer at Memorial Hospital, New York City (Senior Fellowship).

Thomas H. Coleman, Madison, Wisconsin, to work on the biology of thyroid tumors at the Massachusetts General Hospital, Boston.

Clarence M. Connelly, Ithaca, New York, to work in biophysics at the University of Pennsylvania, Philadelphia (Predoctoral Fellowship, renewal).

Arthur R. T. Denues, Bruceton, Pennsylvania, to carry on biological research at the Massachusetts Institute of Technology.

George C. Escher, New York City, to work on newer methods in cancer therapy at Memorial Hospital, New York City.

Peter Flesch, Chicago, Illinois, to work on the metabolism of human skin in relation to malignancy at the University of Chicago.

Howard Gest, St. Louis, Missouri, to work in the field of enzyme chemistry at Washington University, St. Louis (Predoctoral Fellowship).

Allan L. Grafflin, Cambridge, Massachusetts, to work on problems of quantitative cytochemistry at the College of Physicians and Surgeons, Columbia University (Senior Fellowship).

Richard M. Halpern, Los Angeles, California, to work on the immunological aspects of cancer at Memorial Hospital, New York City.

Charles M. Huguley, Atlanta, Georgia, to work on newer methods in the chemotherapy of the leukemias and related blood disorders at the University of Utah Medical School, Salt Lake City (renewal).

William McK. Jefferies, Richmond, Virginia, to work on the biology of thyroid tumors at the Massachusetts General Hospital.

Nathan Kaliss, New York City, to work on the genetic aspects of cancer at the Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Maine (Senior Fellowship).

Fred Karush, Elmhurst, New York, to work on the specificity of protein interactions at New York University College of Medicine, New York City (Senior Fellowship).

Roger A. Lewis, Bethesda, Maryland, to work on the influence of hormones upon growth and development at Johns Hopkins University School of Medicine, Baltimore (Senior Fellowship).

Saul Malkiel, Brookline, Massachusetts, to work on the immunochemistry of viruses at the Rockefeller Institute for Medical Research, Princeton, New Jersey (Senior Fellowship, second year).

Robert C. Mellors, Rye, New York, to work on the endocrine and histochemical aspects of cancer at Memorial Hospital, New York City (Senior Fellowship).

William L. Money, Cambridge, Massachusetts, to work on factors influencing the release and action of the thyroid-stimulating hormone at the Massachusetts General Hospital.

James J. Nickson, Chicago, Illinois, to work on radiation therapy of cancer at Memorial Hospital, New York City (Senior Fellowship).

David Pressman, Los Angeles, California, to work on the immunochemistry of normal and malignant tissues at the California Institute of Technology, Pasadena (Senior Fellowship, second year).

Paul B. Reaser, New Orleans, Louisiana, to work on the use of isotopic tracers in biological research at Tulane University, New Orleans (Senior Fellowship).

John M. Reiner, St. Louis, Missouri, to work on problems of enzyme synthesis at Washington University, St. Louis.

Robert L. Sinsheimer, Cambridge, Massachusetts, to work in the field of biophysics at the Massachusetts Institute of Technology (Predoctoral Fellowship, renewal).

Wilson R. Slaunwhite, Winthrop, Massachusetts, to work in the field of organic chemistry at the Massachusetts Institute of Technology (Predoctoral Fellowship, renewal).

Arnold H. Sparrow, Cambridge, Massachusetts, to work on the use of tracer methods in cytological studies at the Massachusetts Institute of Technology (Senior Fellowship).

Morris A. Spirtes, New York City, to work on the chemotherapy of cancer at Johns Hopkins University School of Medicine, Baltimore.

Lotti M. Steinitz, New York City, for a cytophysiological study of growth in plants at the University of Wisconsin.

Henry J. Tagnon, Brookline, Massachusetts, for a clinical study of cancer patients at Memorial Hospital, New York City (Senior Fellowship, second year).

Timothy R. Talbot, Bala Cynwyd, Pennsylvania, to work on the use of tracer techniques in the study of blood diseases at Evans Memorial Hospital, Boston (renewal).

Irving A. Tittler, Brooklyn, New York, to work on the effects of carcinogenic

Hopkins Marine Station of Stanford University, Pacific Grove, California.

Richard B. Turner, New Haven, Connecticut, to work on the synthesis of steroid hormones at Harvard University (Senior Fellowship, second year).

Donald B. Zilversmit, Oakland, California, to work on phospholipid synthesis by animal tissues in normal and pathological states at the University of California, Berkeley (Predoctoral Fellowship).

The membership of the Committee on Growth is as follows: C. P. Rhoads, Memorial Hospital, chairman; Willard M. Allen, Washington University; R. Keith Cannan, New York University; A. R. Dochez, Columbia University; E. Newton Harvey, Princeton University; Charles Huggins, University of Chicago; Frank B. Jewett, National Academy of Sciences; Allan T. Kenyon, University of Chicago; C. C. Little, Roscoe B. Jackson Memorial Laboratory; Perrin H. Long, Johns Hopkins University; John J. Morton, Jr., University of Rochester; James B. Murphy, Rockefeller Institute; Eugene P. Pendergrass, University of Pennsylvania; John M. Russell, The John and Mary R. Markle Foundation; Florence R. Sabin, member emeritus, Rockefeller Institute; E. W. Sinnott, Yale University; M. A. Tuve, Carnegie Institution of Washington; and M. C. Winternitz, Yale University. Drs. Rhoads, Cannan, Harvey, Kenyon, Long, and Tuve and Mr. Russell serve also as a Fellowship Section, of which the latter is chairman.

Recent Deaths

Charles H. Taft, 56, associate professor of pharmacology, University of Texas School of Medicine, died suddenly in his office of cerebral hemorrhage on April 3.

Julio Cesar Tello, 67, director, Peruvian Archaeological Museum, and professor of archaeology and anthropology, San Marcos University, died June 4.

Jules Charles Abels, 33, cancer research specialist and assistant attending physician, Memorial Hospital, Center for Cancer and Allied Diseases, died June 13 of a heart ailment in his home in New York City.

Arthur J. Walscheid, 72, founder and chief gynecologist, North Hudson Hospital, Weehawken, New Jersey, died June 14 in the hospital after a brief illness.

Jean Capart, 70, onetime director of the Brussels Royal Museums of Art and History, Belgium, and advisory curator of Egyptology at the Brooklyn Museum, died June 16 in Brussels.

F. E. Chidester, 62, consultant in nutrition and endocrinology, and formerly professor, Extension Division, New York State College of Forestry, Syracuse, New York, died suddenly June 19 in Newark Valley, New York.

Many works of Mayan art spanning seven or eight centuries have been recovered from burials in a single mound near the village of Nebaj, in the little-known northern highlands of Guatemala, by archaeologists of the Carnegie Institution of Washington during excavations recently brought to an end by the onset of the rainy season. Included among the finds are a jadeite plaque or breast ornament, the finest example of Maya jade carving yet discovered; an urn with a human head on the cover; pendants of jade; a perfectly shaped thin alabaster jar; a vase of plumbate pottery; an elaborate pottery whistle; and many other items of value. All of the artifacts and works of art discovered at Nebaj this year have been placed in the Guatemala National Museum, Guatemala City, in accordance with agreements between the Government of Guatemala and the Carnegie Institution. The investigation is contributing valuable knowledge of the Maya, whose position as the most brilliant exponent of higher aboriginal culture in the western world in the days before Columbus is uncontested.

The American Mathematical Society will publish the Collected Mathematical Papers of the late George David Birkhoff. The Papers, totaling approximately 1,800 pages, will be published in three quarto-size volumes by the photo-offset process. A tentative price of $18 has been set for the three volumes. Members of the Society making a pre-publication subscription will be offered a 30 per cent discount. Contributions and subscriptions are urgently needed at this time to assure the success of the project. The Society will begin publication when $6,000, half the estimated cost of publishing, has been pledged. Contributions and prepublication subscriptions should be sent to J. R. Kline, Secretary, American Mathematical Society, University of Pennsylvania, Philadelphia 4, Pennsylvania.

The Imperial Bureau of Pastures and Forage Crops, Great Britain, has become the Imperial Bureau of Pastures and Field Crops, directed by R. O. Whyte. In its expanded form, it will publish a second abstracting journal, in addition to *Herbage Abstracts*, and will cover literature on the following crops not already covered by the Bureaus of Plant Breeding and Genetics, or Soil Science: all cereals, field root crops, pulses, groundnuts, cotton and other fiber crops grown on a field scale, sugar beets and sugar cane. Continued attention will be given to those aspects of plant biological research which refer to the crops now covered. Research workers, institutes, and departments are invited to send their publications and reports concerned with these crops to the Bureau of Pastures and Field Crops, Penglais, Aberystwyth, Wales, England, for review in the new abstracting journal.

UNESCO is distributing a collection of files of scientific periodicals which was offered by the University of the Witwatersrand, Johannesburg, South Africa, among war-devastated libraries of Europe. Twenty-six sets of these periodicals have now been allocated to eight libraries in Belgium, Denmark, and Poland.

The New York Botanical Garden announces the appointment of P. P. Pirone, associate professor of plant pathology, Rutgers University, as plant pathologist, succeeding B. O. Dodge. Richard A. Howard will also join the staff August 1 as assistant curator, specializing in tropical botany. Donald Philip Rogers, University of Hawaii, will become curator in the cryptogamic herbarium September 1.

The Korean Society for Scientific Agriculture was organized June 7, 1947 at Seoul, Korea. Active membership in the Society is open to graduates in agriculture, forestry, sericulture, and fisheries, and to persons who have made outstanding contributions to agriculture and the associated sciences. H. K. Lee, director, Department of Agriculture, was elected chairman and V. H. Florell,

chemicals on growth in protozoa at the agronomist, U. S. Military Government in Korea, vice-chairman. Branch societies, one each in Kyonggi Do and Kang Won Do provinces, were organized earlier and have been holding regular meetings.

The New York Academy of Medicine has recently organized a Section on Microbiology. The main objectives of this section will be the encouragement of the exchange of information among microbiologists and the promotion of ready contacts between clinical and laboratory investigators. The Fellowship of the section will be broad, including not only those who have a direct interest in microbiology, but also those who deal with microbiology in their primary functions as clinicians or scientists in other branches. The officers of the new section are: Gregory Shwartzman, Mount Sinai Hospital, chairman; Harry Most, New York University College of Medicine, secretary; and René J. Dubos, Rockefeller Institute for Medical Research, Frank L. Horsfall, Jr., Rockefeller Institute for Medical Research, Colin M. MacLeod, New York University College of Medicine, Ralph S. Muckenfuss, Research Laboratories, New York City Health Department, and John G. Kidd, Cornell Medical College, advisory committee.

Chicago Natural History Museum has acquired a large and important collection of plants from Ecuador, assembled and presented by M. Acosta Solis of that country. According to Julian A. Steyermark, assistant curator of the herbarium, this is the largest collection from Ecuador so far received by any institution. It is also one of the largest from a South American country to have reached the Museum.

Make Plans for—

Fifth International Pediatrics Congress, July 14–17, Waldorf-Astoria Hotel, New York City.

Symposium on Sound, July 21–22, University of Utah, Salt Lake City.

Conference on Algebra, July 25–28, University of Michigan, Ann Arbor.

American Association for the Advancement of Science, 114th Meeting, December 26–31, Chicago, Illinois.

COMMENTS *by Readers*

Perhaps no words are more often used incorrectly by systematists and their colleagues than *availability* and *validity*. The words are often erroneously used interchangeably and even with still a third meaning. Actually, three clear-cut concepts are involved: (1) simple proposals of names, whether in compliance with "legal" requirements or not; (2) "legally" acceptable proposals; and (3) "legally" acceptable proposals which can be recognized. An understanding of these concepts and the proper expression for each would greatly simplify and clarify nomenclatural discussions. The frequency with which they are inadequately distinguished has led to almost endless confusion.

For example, all of the following are occupied: *Scincus americanus* Petiver 1711, *Henicognathus annulata cyclura* Cope 1886, *Coluber novae Hispaniae* Gmelin 1788, *Bascanium semilineatum* Cope 1891, *Coluber arizonae* Boulenger 1894, and *Salvadora grahamiae* Baird and Girard 1853. All have been published in journals or books generally available to the public. Accordingly, *any name, once published, is occupied;* it may be available and/or valid or not.

However, *Scincus americanus* Petiver 1711, *Henicognathus annulata cyclura* Cope 1886, and *Coluber novae Hispaniae* Gmelin 1788 are not available (and therefore cannot be valid), since each violates at least one requirement of the International Rules of Zoological Nomenclature. The first name is pre-Linnaean (acceptable names must have been proposed after January 1, 1758); the second is a *nomen nudum* (no diagnosis or definition accompanied the name); and the third is not binomial (acceptable names must be proposed in a binomial system of nomenclature, although they may be trinomial). *Any name published in accordance with the International Rules of Zoological Nomenclature is both occupied and available,* whether valid or not.

Of the remaining names, only *Salvadora grahamiae* Baird and Girard 1853 is valid; it was properly proposed and is a synonym of no other name. *Bascanium semilineatum* Cope 1891 is a zoological synonym of *Masticophis bilineatus* Jan 1863, and *Coluber arizonae* Boulenger 1894 is a nomenclatural synonym of *Arizona elegans* Kennicott 1859. *Only an available name whose "title" to a species is clear* (*i.e.* which is neither a synonym nor a homonym of an earlier name) *can be valid.*

It is obvious that, at any one time, there can be only one valid name for a species, although there may be several available names and even more occupied names. Likewise, it is apparent that while all available names are occupied, not all occupied names are available. (HOBART M. SMITH, *Department of Zoology, University of Illinois, Urbana.*)

Recently, Traub and Slattery (*Plant Physiol.*, 1947, **22,** 77–87) observed that the invertase of bottom fermentation yeast differed markedly from that of top yeast in the effectiveness with which it hydrolyzed the levulins in the residue of the 89 per cent ethanol extract of guayule plants, *Parthenium argentatum* A. Gray. It is of interest to compare this observation on the hydrolysis of levulins with reports of earlier work with inulin in which it had been stated that enzymic hydrolysis of inulin [β-D-furanofructosidase activity] was an aspect of the invertase (sucrase or saccharase) of autolyzed yeast (Lindner. *Wschr. Braeu.*, 1900, **17,** 713–716, 762–765; Kuhn. In Hoppe-Seyler's *Z. physiol. Chem.*, 1923, **129,** 59–63; and especially Weidenhagen, as cited by Bamann and Myrbraeck in *Die Methoden der Fermentforschung*, 1940, p. 1900). Weidenhagen identified inulase as β-h-fructosidase, although he found that his preparation hydrolyzed sucrose 5,000 times as actively as it did inulin.

The data presented by Traub and Slattery show that under the experimental conditions top invertase hydrolyzed from 30 to 65 per cent more of the levulins present than were similarly hydrolyzed by bottom invertase. The ratio of the two kinds of activity in invertase preparations from top fermentation yeast differed from the analogous

ratio from bottom yeast by that amount. Hence, it is probable that each preparation is a mixture of enzymes among which are a sucrase and a β-D-furanofructosidase, but not in the same proportion. It is, of course, by no means certain that "invertases" of top and bottom fermentation yeast from any other source would have the same composition or activity as that used here. Plant physiologists were warned as early as the first quarter of the present century that commercial invertase preparations may split other polysaccharides (*i.e.* melibiose) than sucrose and raffinose (Hudson, and Hudson and Harding. *J. Amer. chem. Soc.*, 1914, **36**, 1570; 1915, **37**, 2193–2198). Thus, after treatment with commercial invertase, unless the other possibilities are disposed of, a reducing power may be found and reported as sucrose or raffinose, when actually the sugar reported may not be present at all (cf. McRary and Slattery. *J. biol. Chem.*, 1945, **157**, 161–167). That this effect is due to the presence of more than one enzyme is indicated by the present work and by that of Zechmeister, Tóth, Fuerth, and Bársony (*Enzymologia*, 1941, **9**, 155), Adams, Richtmeyer, and Hudson (*J. Amer. chem. Soc.*, 1943, **65**, 1369–1380), and Pigman (*J. Res. nat. Bur. Stand.*, 1943, **30**, 159–175).

The top and bottom invertases used in the experiments were purchased from the Wallerstein Laboratories, 180 Madison Avenue, New York 16, New York. (HAMILTON P. TRAUB, E. L. GREEN, and M. C. SLATTERY, *Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture.*)

Schizophrenia strikes 1 or 2 per cent of the population of the United States, mostly those between 15 and 35 years of age. (An exact figure of the incidence of schizophrenia in the general population has not been obtained. Kallman uses .85 per cent. But, as he states that 20 institutions in the state of New York in 1945 had 72,252 patients, of which 47,929 were schizophrenics and 12,316 new admissions, and as a report by Pollock, Malzberg, and Fuller (*Hereditary and environmental factors in the causation of manic-depressive psychoses and dementia praecox.* Utica, N.Y.: State Hospital Press, 1939) indicates that some 4.5 per cent of the population will be hospitalized some time in their lives because of mental disease, it seems not unreasonable to suppose that the incidence of schizophrenia in the general population may reach 2 per cent.) A large proportion of these 1,400,000 to 2,800,000 unfortunate people require care in public institutions for the remainder of their lives. What causes all this misery? Does it arise from external causes or from within?

A great deal of light is thrown on these questions by two studies which are not likely to come to the attention of *Science* readers by reason of their places of publication. These studies were made by Franz J. Kallman, using the "Twin Family Method." The first of these is a book of nearly 300 pages (*The genetics of schizophrenia.* New York: J. J. Augustin, 1938). That it has not received the attention it deserves may be due to the large amount of pertinent accessory material, which tends, nevertheless, to discourage perusal. The second is of recent publication (*Amer. J. Psychiat.*, 1946, **103**, 309).

Both studies have been made with meticulous care. The first is on 1,087 schizophrenics and their relatives, covering in all 13,851 persons. The second is based on 174 pairs of monozygotic (one-egg) twins and 517 pairs of dizygotic twins and 4,394 other relatives. The material is, therefore, statistically reliable. Together they present a thoroughly comprehensive picture of the role of heredity in the etiology of schizophrenia, by showing that the incidence of schizophrenia among relatives of schizophrenics increases directly as the degree of biological relationship increases. Thus, the incidence of schizophrenia among step-sibs—which usually are not biologically related to the schizophrenic—is 1.8 per cent; in half-sibs, 7.0 per cent; in full sibs, 14.3 per cent; and in dizygotic twins, 14.7 per cent. (The incidence of schizophrenia in the co-twins of dizygotic pairs of the same sex is 17.4 per cent for males and 17.6 per cent for females, as against 10.3 per cent for twins of opposite sex. This may perhaps be referred to differences in environment associated with sex.) In monozygotic twins it rises to 85.8 per cent.

In examining these statistics, it is to be understood that the question answered is: Given a schizophrenic, how many schizophrenics are found among relatives of a given degree of biological relationship? Thus, in the case of twins, there being only one relative of the degree named, the question becomes: What proportion of the co-twins develop schizophrenia? The contrast in the incidence of schizophrenia in the co-twins of schizophrenic monozygotic twins and those of schizophrenic dizygotic twins is plain evidence of the predominating part played by inheritance in the etiology of schizophrenia. This contrast can arise only because both twins of a monozygotic pair are guided in their development by identical sets of genes, while the genes of dizygotic twins differ in exactly the same way that the genes of ordinary sibs differ.

The failure of a small proportion of the co-twins of the monozygotic twins to develop schizophrenia indicates that, under favorable circumstances (environment), a person with the inheritance for schizophrenia may not reach the clinical or hospitalization stage. Nevertheless, with a single exception, all co-twins in Kallman's series of monozygotics showed evidence of their schizophrenic constitution by those personality characteristics which are called schizoid by psychiatrists. All in all, then, it appears that schizophrenia develops only in persons of a certain genetic constitution. (H. D. GOODALE, *257 West Main Street, Williamstown, Massachusetts.*)

In connection with the 4th Microbiological Congress being held in Copenhagen this month, Michael Heidelberger, president, American Association of Immunologists, has forwarded to *Science* a letter written by Ludwik Hirszfeld of Wroclaw to Thorvald Madsen of Copenhagen. According to the letter, during the German occupation 2,000 Polish scientists and physicians were murdered, many of them having died as a result of experimental operations; two of the leading bacteriologists, Prof. Fleck and Privatdozent Mayzel, "were obliged to work in the laboratory of concentration camps"; and Polish universities were closed for the duration of the occupation, most of the books and apparatus having been removed to Germany with the assistance of German professors. Prof. Hirzfeld, who himself survived the occupation by hiding under a foreign name, concludes: "And so we hope that the Danish scientists will understand that we have no right and no intention to forget and that we don't wish to meet those whom we consider as actively or passively responsible for these crimes."

TECHNICAL PAPERS

On the Geochemistry of Columbium

KALERVO RANKAMA[1]

Saratoga Springs, New York

In an earlier paper the present author (*8*) has discussed the geochemistry of tantalum, in this respect, thus far, one of the more imperfectly known elements. Later an investigation of the geochemistry of columbium was carried out, based on substantially the same material. The present paper is a condensation of the results obtained.

The laboratory work was carried out in the Geochemical Laboratory, Institute of Geology, University of Helsinki, Finland. The Cb contents of the samples were determined by means of spectrochemical analysis, using a new, previously described technique (*10*).

There are some 30 to 40 species which can be classified as Cb minerals proper. Columbite and tantalite are the most common

TABLE 1

	Cb_2O_5 (max. %)
Titanium minerals:	
Titanomagnetite	0.055
Ilmenite	1.3
Perovskite	4.7
Rutile	0.29
Anatase	0.067
Brookite	0.033
Sphene	3.3
Keilhauite	1.2
Zirconium minerals:	
Zircon	2
Woehlerite	>5
Astrophyllite	2.15
Eudialite	2.35
Eucolite	4.0
Catapleiite	2.2
Other minerals:	
Magnetite	0.026
Cassiterite	3.4
Wolframite	>5
Garnet group	0.001
Thorite	0.31
Tourmaline group	0.007
Thortveitite	0.95
Pyroxene group	0.013
Amphibole group	0.016
Muscovite	0.033
Biotite	0.188

of the species in question. In minerals, Cb is found to replace Ta diadochically and to enter in a number of Ti-, Zr-, Sn-, and W-bearing, and in small amounts in Cr- and Mn-bearing, minerals. The content of Cb in certain minerals and mineral groups is presented in Table 1, which also contains information furnished by von Hevesy, Alexander, and Würstlin (*5*), Borowsky and Blochin (*1*), Panteleyev (*7*), and Sahama (*11*).

As is known from work of previous investigators, the cassiterites sometimes contain high amounts of Cb. According to Goldschmidt (*4*), this fact is due to the presence of Sc and Fe columbates, $ScCbO_4$ and $FeCb_2O_6$, in the cassiterite. The electric balance is maintained by the simultaneous addition of one Sc^{3+} to every Cb^{5+} or of one Fe^{2+} to every two Cb^{5+}. Also, in wolframite $ScCbO_4$ is responsible for the presence of Cb. In Ti minerals Cb is found to replace Ti, being captured in place of this element. Some of the magnetites investigated contain traces of Cb, evidently due to the presence of small amounts of Ti in the lattice. The occurrence of Cb in Zr minerals and perhaps also in thorite is explained in a similar way.

As is shown by Sahama (*11*), Ca must be replaced by Na in sphene to maintain the electrostatic neutrality of the lattice if Ti is replaced by Cb. This rule may be extended to cover such

TABLE 2

	Cb_2O_5(%)	Cb:Ta
Monomineralic rocks	0.00004	0.4
Ultrabasic rocks	0.0023	16.4
Eclogites	0.0005	5.3
Gabbros	0.0027	17.7
Diorites	0.00052	5.5
Granites	0.003	5.0
Syenites	0.005	17.1
Nepheline syenites	0.045	394.1
Basic alkaline rocks	0.002	11.4

minerals as garnet, tourmaline, the pyroxenes, and the amphiboles. The high Cb content of thortveitite is interesting and might lead to a re-examination of the chemistry of this mineral.

The micas, muscovite and biotite, contain appreciable amounts of Cb, for which there is adequate room in the capacious mica lattice. It is also evident that in biotite Cb can replace Ti. Rather high Cb_2O_5 contents are reported by Stevens (*14*) to occur in lepidolites, the maximum being 1.52 per cent in a polylithionite from Greenland.

In addition, small traces of Cb varying from some thousandths to some millionths of a per cent, are occasionally found in many sulfides, e.g. sphalerite, chalcopyrite, galena, and pyrite; the carbonates, siderite and calcite; anhydrite; scheelite; monazite and apatite; vanadinite; olivine, kyanite, topaz, beryl, nepheline, the feldspars; and still other minerals. In these cases, the adsorption of Cb compounds, such as soluble alkali metacolumbates $NaCbO_3$ and $KCbO_3$, is suggested as the cause of the contamination, in the sense extensively studied by Seifert (*12*, *13*).

The third group of minerals includes: halides; corundum, hematite, quartz; barite, gypsum; cordierite, talc, antigorite, leucite; most of the feldspar minerals investigated; and many other species which were found to be free from Cb.

[1] Present address: Department of Geology, University of Chicago.

The Cb contents of the different groups of igneous rocks, together with the Cb: Ta ratios, are presented in Table 2.

A remarkably high Cb content is found in ultrabasic rocks, comparing well with the average content in granites. This is evidently due to the high Ti content of these rocks, and we deal here with the replacement of CaTi by NaCb, which is, according to Niggli (*6*), responsible for the separation of Cb from the magma at a relatively early stage. Similar causes might well be responsible for the high content of this element in gabbroic rocks. In granites the concentration of Cb in the residual liquors will become evident, but the highest contents are arrived at in syenites and nepheline syenites. In this respect Cb clearly differs from Ta, which shows a maximum in granites. These results are in accordance with the observations of Goldschmidt (*2*) that both Cb and Ta are elements characteristic of granite pegmatites, while the latter element, contrary to Cb, is a less pronounced denizen of nepheline syenite pegmatites. This is clearly seen also by the Cb:Ta ratios of the two rock classes.

TABLE 3

	Cb_2O_5(%)	Cb:Ta
Minerogenic sediments	0.0018	9.0
Chemical "	0.00006	2.6
Organogenic "	0.00009	3.8
Deep sea "	0.0059	41.9

The Cb contents for sedimentary rocks are given in Table 3. As in igneous rocks, Cb in sedimentary rocks is more common than Ta. It is of interest to note the concentration of Cb in hydrolysate sediments in the beginning of the exogeneous cycle, and its even more pronounced concentration in the deep sea sediments, where the highest amounts are present in the manganese nodules.

No figures will be offered with respect to metamorphic rocks, since the geochemistry of metamorphism is, as yet, known very incompletely.

TABLE 4

	Cb_2O_5(%)	Cb:Ta
Silicate meteorites	0.000072	1.3
Meteoric irons	0.000029	3.5

The Cb contents of the meteorites are presented in Table 4 As may be seen, the amounts present are quite low.

The occurrence of Cb in mineral lattices has already been discussed. The main results are that Cb and Ta are mutually camouflaged in many minerals and that, in the mineral kingdom, Ti and Zr are the most powerful carriers of these elements. Both Cb and Ta are true satellites of Ti. As Cb is quite widely distributed in minerals, it may also be considered a quite mobile element.

By the study of the occurrence of Cb in different mineral groups and rocks the concentration of this element can be followed toward the end of magmatic crystallization. A fine example of the growing concentration of Cb with the proceeding differentiation is afforded by a series of analyses from Lapinlahti, Finland (Table 5).

During the exogeneous differentiation, a large proportion of Cb is accumulated in the hydrolysate sediments at a comparatively early stage. It may be pointed out that the average content of Cb_2O_5 in Baltic clays (0.003 per cent) is equal to the Cb average in granites. Some Cb, quite naturally, is always present in transported deposits, due to the hardness and resistance to chemical decomposition of the minerals in question. In hydrolysates the highest Cb contents are found in bauxites and laterites.

Another part of Cb is present in sea water, perhaps as a soluble alkali columbate, as is seen by its presence in marine carbonate sediments and in anhydrite. Cb is finally deposited in the deep sea sediments, the manganese nodules being especially rich in this element. This is one minor phase in the universal depoisoning of ocean water.

TABLE 5

Lapinlahti rocks	Cb_2O_5(%)
Bytownite rock	0
Hornblendite	0
Olivine gabbro	0.000008
Bytownite gabbro	0.00009
Gabbro	0.0007

The presence of Cb in certain biological substances seems to point to the possibility that this element might be able to form organometallic compounds.

All collected evidence of the general geochemical character of Cb emphasizes the purely lithophile character of this element. In addition, it belongs to the group which, on a previous occasion, has been named "granitophile" (*9*).

The average Cb content in igneous rocks is given in Table 6, together with the corresponding Ta values and the Cb:Ta ratio. The value for Cb is in close agreement with a previous average (0.002 per cent) given by Goldschmidt (*3*).

A few words may be added on the concentration of Cb in mineral deposits of economic importance. Nigeria is the most important present-day source of columbite high in Cb. This element has received considerably more attention since 1936, because of the demand of the stainless and alloy steel industries for columbite free from Ta.

TABLE 6

Cb_2O_5(%)	0.0034
Cb (%)	0.0024
Ta_2O_5(%)	0.00026
Ta(%)	0.00021
Cb:Ta	11.4

The study of the regional geochemistry of Cb reveals the concentration of this element in some local and areal centra, while other regions and geological units are known which are nearly or completely devoid of this element. In this respect the behavior of Cb is similar to that of Ta. The occurrence of Cb in the Pre-Cambrian granite groups of Finland offers results of considerable interest. There is, as in the case of Ta, a secular increase in the amount of Cb toward the geologically younger granites. However, the Post-Archean rapakivi gran-

tes form a break in this rule: they form a coherent group, independent by their geological occurrence and by their petrological, chemical, and geochemical properties.

The geochemical comparison between Cb and Ta manifests that Cb is the more common and more abundant of the two. With the use of the abundance number of Cb in igneous rocks, one can approach the question of whether or not this element follows the rule of Oddo and Harkins, according to which the elements with odd atomic number are more rare than their neighboring elements which flank them in the Periodic Table. Thus, we should expect that Cb is less abundant than Zr and Mo. The abundances of these three elements, expressed in grams per metric ton, are: Zr, 220; Cb, 24; Mo, 15. Cb most certainly does not follow the rule, but the cause of this deviation may probably be found in the too small value of Mo.

It may be stated, as a general rule, that Cb and Ta commonly occur together, and that minerals and rocks relatively high in one are also usually high in the other. Thus, these elements form a quite coherent pair, as can be expected from the similarity of their ionic radii (Cb^{5+}, 0.69A.; Ta^{5+}, 0.68A.), this being due to the lanthanide contraction, further, from the similarity of their ionic charges and of their ionic types. There is also a marked chemical similarity between these two elements. It could thus be expected that no pronounced separation between them would take place in Nature.

However, this pair is not too coherent, and it is inferior to the rare earths or to the pair Zr-Hf, as is shown by the fact that its component elements are quite often actually separated in Nature. It is even possible to find a geological unit, or area, where, in some minerals at least, the normally less abundant of these two elements predominates. Compared with the pair Zr-Hf, it is noted that geochemical camouflage is in no other case more pronounced than that of Hf by Zr. In conclusion, while easily capable of separating Cb and Ta, Nature is unable to separate Hf from Zr with her methods of analysis. This fact is reflected also in certain chemical features of these elements: no method of everyday chemical analysis is known which is suited for the determination of Hf in the presence of Zr, the separation of Hf from Zr being unexampled in difficulty. Cb and Ta, on the other hand, can be comparatively easily separated from each other by Marignac's method, and routine determinations of these elements by the ordinary methods of chemical analysis are carried out in many laboratories.

References

1. Borowsky, I. B., and Blochin, M. A. *Izvest. Akad. Nauk. S.S.S.R.* (Geol. Ser. No. 5), 1937, 929.
2. Goldschmidt, V. M. *Nachr. Ges. Wiss. Göttingen*, 1930, Math.-physik. Klasse III, 7; IV, 4.
3. Goldschmidt, V. M. *Skr. Norske Videnskaps-Akad. Oslo*, 1937, Mat.-Naturv. Klasse No. 4.
4. Goldschmidt, V. M. *Chem. Prod.*, March–April 1944.
5. Hevesy, Georg v., Alexander, E., and Würstlin, K. *Z. anorg. allg. Chem.*, 1929, **181**, 95.
6. Niggli, Paul. *Schweiz. mineralog. petrog. Mitt.*, 1932, **12**, 204.
7. Panteleyev, P. G. *Izvest. Akad. Nauk. S.S.S.R.* (Geol. Ser. Nos. 5-6), 1938, 827.
8. Rankama, Kalervo. *Bull. Comm. géol. Finlande No. 133*, 1944.
9. Rankama, Kalervo. *Bull. Comm. géol. Finlande No. 137*, 1946.
10. Rankama, Kalervo, and Joensuu, Oiva. *C. R. Soc. géol. Finlande No. 19; Bull. Comm. géol. Finlande No. 138*, 1946, 8.
11. Sahama, Th. G. *C. R. Soc. géol. Finlande No. 19; Bull. Comm. géol. Finlande No. 138*, 1946, 88.
12. Seifert, H. *Mineralog. petrog. Mitt.*, 1934, **45**, 191.
13. Seifert, H. *Fortschr. Mineral. Krist. Petrog.*, 1937, **22**, 185.
14. Stevens, Rollin E. *Amer. Mineral.*, 1938, **23**, 607.

Sensitivity of Grasses and Some Crop Plants to Isopropyl-N-Phenyl Carbamate

John W. Mitchell and Paul C. Marth

Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, Beltsville, Maryland

It has been reported that some urethanes injure or kill grass plants when applied to soil in which the plants are growing (*1*, *2*). Greenhouse experiments were undertaken in October 1946 to study the sensitivity of various grasses to isopropyl-n-phenyl carbamate (IPC) and to compare their sensitivity to this compound with that of some dicotyledonous plants.

Seeds of grasses and dicotyledonous plants were sown in fertile potting soil to which known amounts of IPC were added.[1] In some experiments the carbamate was first mixed with a small amount of quartz sand, and this mixture was then added to soil and the seeds planted. In other experiments the carbamate-sand mixture was spread evenly on the surface of the soil after it had been potted and the seeds planted. The amount of sand used was 10 grams/pound of soil.

The IPC affected the growth of grass seedlings in varying degrees, depending on the method of application. When applied to the surface of soil at a rate equivalent to 2 pounds/acre (calculated on an area basis), IPC prevented the emergence of quack grass seedlings,[2] while 91 per cent of the seeds planted in comparable untreated soil emerged and grew vigorously. When the same amount of carbamate was worked into the upper 1 inch of soil, the treatment was less effective since 18 per cent of the quack grass seedlings emerged and grew vigorously. IPC applied at a rate equivalent to 2 pounds/acre and cultivated into soil to a depth of approximately 4 inches was even less effective in inhibiting the emergence of the seedlings.

TABLE 1

Emergence of Bluegrass and Crab Grass Seedlings*

Mg. IPC/ pound of soil	Bluegrass†		Crab grass	
	A	B	A	B
0.0	80	57	29	18
3.4	5	3	30	27
10.2	11	0	31	21
20.4	8	0	39	22
40.8	3	0	40	25

*Values represent average percentages of emergence in successive experiments, A and B. Four replications of each treatment (4 × 50 seeds) were used for each experiment.

†Although some bluegrass plants emerged in treated soil, they failed to grow more than ½ inch above the surface.

Differences in the sensitivity of grasses to IPC became apparent when crabgrass and bluegrass seeds were planted in soil containing known amounts of the chemical. Emergence of bluegrass seedlings was greatly reduced in soil that contained as little as 3.4 mg. of IPC/pound, while the emergence percentage for crab grass (*Digitaria sanguinalis*) increased with the addition of IPC to the soil (Table 1). Toole (*3*) has reported that the germination percentage for crab grass (*D. ischaemum*) was in-

[1] Compound furnished by J. T. Baker Chemical Company, Phillipsburg, New Jersey.

[2] Quack grass seeds furnished by O. M. Scott & Sons Company, Marysville, Ohio.

creased through the addition of nitrates. Although the emergence percentage of partially dormant crab grass was apparently stimulated by IPC in this experiment, the subsequent growth of the plants was greatly inhibited.

TABLE 2

SENSITIVITY OF SOME MONOCOTYLEDONOUS PLANTS TO IPC WHEN APPLIED TO THE SOIL AT A RATE EQUIVALENT TO 5 POUNDS/ACRE*

Plant	Emergence index	Plant	Emergence index
Bermuda grass	130	Fescue	0
Amber sorghum	99	Ryegrass	0
Sudan grass	88	Redtop	0
Millet	86	Timothy	0
Bluegrass	4	Orchard grass	0
Barley	0	Quack grass	0

*Values represent relative emergence from seeds planted in treated soil calculated on the basis that emergence in comparable untreated soil equaled 100 per cent.

On the basis of the emergence percentage of grass species tested, the effect of IPC when added to soil varied from complete inhibition in the case of quack grass, fescue, and others (Table 2) to stimulation of growth during the very early stages of development of Bermuda grass and crab grass (Tables 1 and 2). Applied at higher rates (30–60 pounds/acre), the effect of IPC on the growth of less sensitive species (sorghum, Sudan grass) was prolonged so that the plants grew above the surface of the soil for a distance of 1–3 cm. and then failed to develop further. Microscopic examination revealed that these plants remained alive but stunted after appearing above the surface. These stunted plants failed to produce seeds.

When IPC was applied at relatively high rates (50 and 100 pounds/acre) to potted soil in which crab grass had become established and had developed leaves extending about 1–2 cm. above the surface of the soil, the plants failed to grow further and died within a period of 2 weeks following treatment.

To observe the effect of the carbamate on the emergence and growth of such crop plants as sugar beets, table beets, carrots, radishes, onions, and spinach, seeds of these crops were planted, together with measured amounts of quack grass seeds, in soil to which different amounts of IPC were added. When applied evenly to the surface of the soil at the rate of 2 pounds/acre, IPC completely prevented the emergence of quack grass seedlings and only temporarily checked the growth of sugar beet seedlings which germinated from seeds planted in the same lot of treated soil (Fig. 1, Table 3). The emergence percentage for onions was not reduced by the presence of IPC in soil at rates of 2, 4, or 8 pounds/acre (Table 3). The growth of radishes was slightly less in soil treated at the rate of 2 pounds of IPC/acre than in untreated soil. The growth of spinach and table beets was not visibly affected by the application of the carbamate at the latter rate to soil in which the seeds were germinated and the plants grown for a period of 6 weeks.

TABLE 3

AVERAGE PERCENTAGES OF EMERGENCE FOR ONION AND SUGAR BEET PLANTED TOGETHER WITH QUACK GRASS IN SOIL TREATED WITH DIFFERENT AMOUNTS OF IPC*

Pounds IPC/acre	Onion	Sugar beet	Quack grass
0	46	76	90
2	69	69	0
4	59	83	0
8	68	66	0

*Carbamate applied to surface of soil at time seeds were planted.

FIG. 1. Measured amounts of sugar beet and quack grass seeds planted together in potted soil. IPC applied to surface of soil immediately after planting at rates equivalent to (1) 0.0; (2) 2.0; (3) 4.0; and (4) 8.0 pounds/acre. Photographed 6 weeks after planting.

IPC is inactivated in the presence of moist, fertile soil (*1*), as is the case with 2,4-D. In testing for the inactivation of IPC, quack grass failed to survive when the seeds were planted in soil to which 40.8 mg./pound of soil had been freshly added.

Subsequent to this test the soil was kept moist in a greenhouse for a period of 2 months, at which time it was reseeded. Eighty-four per cent of the quack grass seeds germinated, and the plants grew vigorously and showed no symptoms of injury, indicating that the carbamate had been inactivated, possibly through the action of soil microorganisms.

The present results from greenhouse experiments indicate that isopropyl-n-phenyl carbamate may be useful in reducing the population of some weedy grasses, such as quack grass, which infest certain crop areas.

References

1. Allard, R. W., Ennis, W. B., Jr., DeRose, H. Robert, and Weaver, R. J. *Bot. Gaz.*, 1946, **108**, 389–596.
2. Ennis, W. B. *Science*, 1947, **105**, 95–96; Templeman, W. G., and Sexton, W. A. *Nature, Lond.*, 1945, **156**, 630.
3. Toole, Eben H., and Toole, Vivian K. *J. agric. Res.*, 1941, **63**, 65–89.

Geomagnetic Control of F_2 Layer Ionization

Edward Appleton

Department of Scientific and Industrial Research, 24, Rutland Gate, London, S.W. 7

In a recent communication to *Nature* (*2*) the author has given a brief account of the results of a study of the world distribution of F_2 layer ionization. Such a study has only become possible in recent years, when, to serve the operational requirements of the Allied Forces, many new ionospheric stations have been set up in different parts of the world. The chief results which have emerged from this study of F_2 layer morphology can best be illustrated by considering the local noon values of critical frequency at the equinoxes, when the earth is symmetrically illuminated by the sun with respect to the geographic equator. From these values it has been deduced that (a) for a constant longitude, the noon values of ionization at the same numerical latitude, north and south of the equator, are not necessarily equal, and (b) there is a variation of noon ionization with longitude along a line of constant latitude. It will thus be seen that, according to these results, it is not possible simply to relate noon equinox values of critical frequency for the F_2 layer to the sun's zenith distance, as is possible in the case of the E and F_1 layers. An additional controlling factor has therefore been sought.

In Fig. 1 is plotted the relation between equinox noon F_2 layer critical frequency and magnetic latitude, using all the data now available to the author for March 1944. It will be seen that the anomalies mentioned above, which appear when ionization density is related to geographic latitude, have now substantially disappeared.

One of the most remarkable features of Fig. 1 is the trough of low values of ionization density centered on the geomagnetic equator. A study of the detailed ionospheric information available from stations between $\pm 18°$ magnetic latitude shows that these low values are associated with a marked bifurcation of the F layer into its two components, F_1 and F_2. The phenomenon can thus be linked with others already identified previously in studies of the seasonal variation of F_2 layer noon ionization at Slough, England (lat. 51½°N.). In measurements made at that station it has been found that there is a remarkable difference between summer and winter conditions. In winter the F layer appears fairly homogeneous and the ionization density is high, whereas in summer, under conditions of reduced solar zenith distance, there is marked bifurcation of the layer into its two components and the ionization of the upper component (F_2 layer) is much reduced. Under such conditions of bifurcation the F_2 layer exhibits entirely different physical characteristics. The electron production rate at the layer maximum is much reduced, as is also the electron recombination coefficient. Moreover, the variation of ionization is no longer substantially symmetrical about noon, there being often a minor minimum at mid-day, the major maximum of the day occurring in the evening.

It is therefore found that the equinox phenomena experienced at stations situated between magnetic latitude $\pm 18°$ are similar to those experienced at Slough in a northern summer, when the ionization in the F layer as a whole is distributed through a great range of vertical heights. On the other hand, the ionization maxima (Fig. 1), at $\pm 18°$ magnetic latitude, are

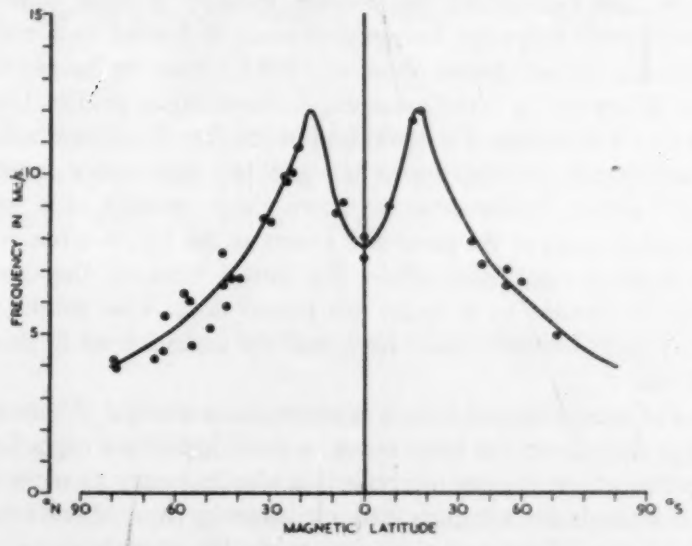


Fig. 1. Relation between equinox noon values of F_2 layer critical frequency and magnetic latitude.

associated with a relatively thin homogeneous F layer without marked bifurcation.

The long-term study of F_2 layer ionization has shown that, as in the case of the E and F_1 layers (*3*), there is marked variation of ionization in sympathy with the trend of the sunspot cycle. Such a correspondence is most strikingly exhibited if ionization density is compared with calcium flocculi figures (*1*). But, in addition, the author has found that the ratio $\frac{N_{max.}}{N_{min.}}$, where $N_{max.}$ and $N_{min.}$ refer to noon ionization densities at sunspot maximum and minimum, respectively, is not constant at any station for each month in the year. For example, this ratio is approximately 4 for the summer months (May, June, and July) at Slough and approximately 2 for the winter months (November, December, and January). Such a variation indicates that either the intensity of the ionizing radiation or the atmospheric medium which is ionized varies throughout the year. A study of similar phenomena at a number of stations in addition to Slough suggests that it is the seasonal variation of the atmospheric medium which is substantially responsible.

References

1. Appleton, E. *Nature, Lond.*, 1939, **144**, 151; Goodall, W. M. *Nature, Lond.*, 1939, **143**, 977.
2. Appleton, E. *Nature, Lond.*, 1946, **157**, 691.
3. Appleton, E., and Naismith, R. *Phil. Mag.*, 1939, **27**, 144.

IN THE LABORATORY

Improved Cage Designs for Use in Handling Monkeys

HOWARD F. BRUBACH

Industrial Hygiene Research Laboratory, National Institute of Health, Bethesda, Maryland

The use of monkeys as experimental animals has always been somewhat of a problem due to the difficulty in handling. This is particularly true of new or unused monkeys.

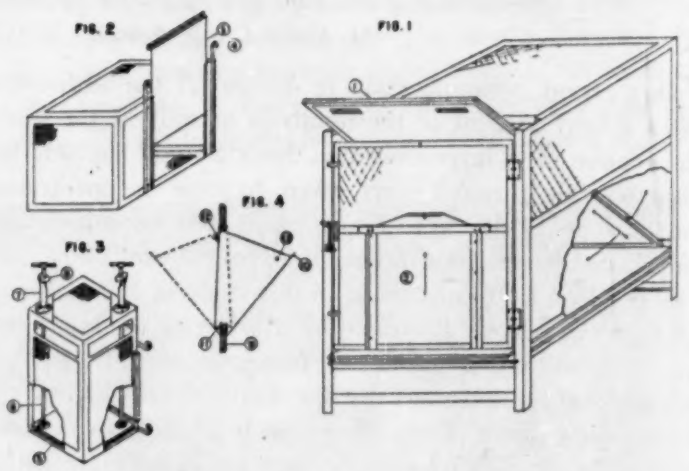
In this Laboratory the Rhesus monkey is used almost exclusively. Although the general stock is housed in a conventional animal house, those selected for tests are housed in the laboratory in large metal cages measuring approximately 28 x 31 x 40 inches. The lower half of the cage is enclosed with sheet metal, and the upper half and top with heavy, large-mesh screen. Underneath the floor, which consists of a removable panel of the same size screen as the top, is a removable pan for catching debris. The entire front of the cage may be opened by a large, side-hinged door. Two monkeys are usually housed in each cage, and the cages are set in tiers of two.

For some types of tests it is necessary to transfer the monkeys daily from the large cages to small individual cages for treatment. At regular intervals it is also necessary to remove the animals for venipuncture, etc. During these operations, which are difficult and time consuming, the animals formerly had to be transferred by hand and forcibly held quiet for the necessary blood work. Occasionally an animal would be injured or would escape and do considerable damage before being caught.

The following is a description of the cages and methods developed in this laboratory to eliminate some of the difficulties encountered in the handling of these monkeys:

The large cages were remodeled in such a way (Fig. 1) that a large, rectangular, plywood "sweep" (1) with hand holes cut in one end can be inserted into a space above the door, and an opening fitted with a sliding door (2) was cut in the lower center of the cage door. This opening is so fitted that a small transfer or exposure cage (Fig. 2), measuring 14 x 14 x 24 inches and fitted with a sliding door (3) which corresponds in width with the slide door on the large cage, can be hung over it by means of strap hooks (4). To transfer the monkeys, both slides are raised and the sweep inserted along the top of the large cage, brought down along the back, and slowly drawn forward. The monkey is forced along in front of the sweep into the small cage. When two monkeys are occupying the large cage, it is not difficult to insert the sweep between them in order to remove one. The sweep is also useful in confining the animals to the upper rear section of the cage when it is necessary to open the slide door or remove the floor screen and the debris pan for cleaning.

For securing the monkeys for the purpose of drawing blood, a separate "elevator" cage (Fig. 3) was designed. This is approximately the same size as the transfer cage and, like it, contains a slide door and hooks for attachment to the large cage. The elevator cage, made with a 2-inch opening extending across the top of each side panel, contains a plywood false bottom (5), or elevator, which can be raised and lowered by means of ½-inch pipe (6) attached to its diagonally opposite corners. The pipe passes through 4-inch nipples (7) of ½-inch pipe, which are attached to the reinforced corners of the top of the cage. The top of these nipples are cut off at an angle and the remaining lip bent back to an angle of approximately 40° to provide a fulcrum point for the outer edge of a large steel washer (8). The top of the ½-inch pipe is provided with T's and short nipples to act as handles. When the elevator is



raised, the washers slide freely on the pipe; when the upward motion is stopped, they cock at an angle and secure the pipe at that point. By lifting the low side of the washers the pipe is released and the elevator can be lowered. After the monkey is transferred to the elevator cage, the elevator is raised until the animal is held securely against the screen at the top. In this position a limb of the animal can be drawn out through the most convenient opening on the side and the necessary work performed with a minimum of disturbance from the animal.

To facilitate the use of the "sweep" in the large cage, feeding and watering bins or troughs that can be swung in and out of the cage from the outside were designed. Fig. 4 is an end view of the bin in a cross section of the cage wall (9). The V-shaped bins, 5 inches wide at the top, 4 inches deep, and 10 inches long, are made of galvanized sheet iron and the bottom rounded on a radius of ½-inch. The end pieces are attached about ½-inch from the top edge of the bin to allow a lip or extension (10) along the top of the sides. The lower parts of the end pieces extend approximately 1 inch below the rounded bottom. An inverted V cut (11) is made into this extension, the apex of the V extending to the bottom of the bin. A rectangular opening is cut at a convenient level in the lower side or rear panel of the large cage to accommodate the bin. This opening is 10 inches long and of a height equal to the distance from the apex of the inverted V to the outer edge of the bin, not including the lip or side extension. Small slide bolts (12) are mounted

horizontally on each side of the opening of the cage, approximately ½-inch from the top. The bin is placed in the cage opening by inserting the lip and allowing the inverted V cut to rest on the bottom of the opening. It can then be swung either in or out until it is stopped by the extension lip on either side of the bin. To secure the bin in the "in" position, the bolts are slid over the outside of the bin; in the "out" position, they are slid into holes (13) drilled into the ends of the bin. When the bin is removed for cleaning, a metal plate slightly larger than the opening and having small tabs bent in on the bottom edge can be inserted to prevent escape of the animals.

Acid Phosphatase and Lipids in the Mast Cells of the Rat[1]

WILLIAM MONTAGNA and CHARLES R. NOBACK

Department of Anatomy,
Long Island College of Medicine, Brooklyn, New York

The presence of alkaline phosphatase and cytochrome oxidase, localized in the form of cytoplasmic granules in the mast cells, has already been reported (*4, 5*). Acid phosphatase has been stated to occur only in negligible amounts in the mast cells (*4*). With a slight modification of the technique of Gomori and of Wolf, Kabat, and Newman (*2*), we have been able to demonstrate that acid phosphatase, like alkaline phosphatase, is abundant in the mast cells. This enzyme is localized in the mast cells as discrete, coarse, cytoplasmic granules, brown to black in color. This localization in granules, in contrast to the diffuse appearance of the enzyme in other tissues (*3*), suggests that possibly these granules which contain acid phosphatase correspond to the mast granules. No phosphatase activity was found in the nucleus.

To demonstrate acid phosphatase activity in tissues embedded in paraffin it is necessary to incubate them in the buffered substrate for comparatively long periods of time. For this reason it is thought that the method is faulty, and that perhaps the enzyme is partially denatured during infiltration in paraffin at high temperatures. For the demonstration of acid phosphatase, tissues are fixed in chilled acetone for 12 hours or longer, cleared in toluol or chloroform, infiltrated in paraffin, sectioned, and mounted in the usual manner. The deparaffinized sections are then incubated at 37° C. in a solution of sodium β-glycerophosphate buffered (acetate) to pH 4.7. In these sections enzyme activity in the mast cells is shown after long periods of incubation and is never clear before 24 hours. Often the section must be incubated 72 hours or longer. Better results are obtained when the paraffin infiltration method is eliminated. Whole mesenteries are spread on pieces of cork (previously immersed in cold acetone) and fixed in chilled acetone overnight. The acetone is removed in several quick rinses of distilled water, and the mesenteries incubated in the buffered substrate at 37° C. Some acid phosphatase activity is noted within 1 hour in granular foci in the mast cells. Maximal enzyme activity is obtained in 4–6 hours. Longer incubation periods are undesirable, because after 24 hours the mast cells become so dark that details are obscured. It seems advisable, then, to eliminate the paraffin method from this technique whenever possible. Perhaps embedding in collodion would be satisfactory, since it does not require infiltration at high temperatures.

Our previous findings do not reveal lipids stainable with Sudan IV in the mast cells of the rat. Although Sudan IV gives consistently negative results in the mast cells, when Sudan black B is applied to frozen sections of tissues fixed in formal calcium-cadmium (*1*), black granules are revealed in the cytoplasm of the mast cells. These lipid granules resist dissolving with solvents and appear to represent phospholipids. Lipid granules have been demonstrated previously in human mast cells (*5*) by the use of Sudan black.

[1] This investigation was supported partially by a grant from the Gans Fund, Bethany College, Bethany, West Virginia.

References

1. BAKER, J. R. *Quart. J. micro. Sci.*, 1944, **49**, 1–71.
2. GOMORI, G. *J. cell. comp. Physiol.*, 1941, **17**, 71–83; WOLF, A., KABAT, E., and NEWMAN, W. *Amer. J. Path.*, 1943, **19**, 423–439.
3. GOMORI, G. *Arch. Path.*, 1946, **41**, 121–129.
4. NOBACK, C. R., and MONTAGNA, W. *Anat. Rec.*, 1946, **93**, 279–287.
5. WISLOCKI, G. B., and DEMPSEY, E. *Anat. Rec.*, 1946, **96**, 249–278.

Sulfur Collection in Precipitation by Means of an All-Weather Noncorrosive Rain and Snow Gauge[1]

M. I. FRIED and M. L. JACKSON

Purdue University Agricultural Experiment Station,
Lafayette, Indiana

Sulfur, an essential element for the growth of plants and animals, is known to be present in three amino acids (cystine, methionine, and djenkolic acid), the tripeptide glutathione, and two vitamins (thiamine and biotin). Increasing attention is being given to the content in foods of the sulfur-containing amino acids (*2*) as factors in food quality. The total sulfur in plants (and possibly the total of these essential sulfur compounds) is increased by increasing the supply of available sulfur in soils (*4*).

In the course of ordinary fertilizer practice, available sulfur has been supplied to the soil in the form of ammonium sulfate, potassium sulfate, and superphosphate. However, with the anticipated increased use of higher-analysis fertilizers these sources of sulfur will be decreased. Thereafter, except for a small reserve in the soil, the chief natural source to growing plants will be that brought down in the precipitation.

With regard to soil reserves, Lipman and Conybeare (*3*) have reported that, on the average, the soils in the United States contain only about 700 pounds of total sulfur/acre. This is for the most part insoluble and unavailable at any one time; also, that becoming available is subject to rapid loss by leaching. Thus, the quantity of sulfur brought down by precipitation will become increasingly important.

In order to measure the sulfur brought to the soil in rain and snow, a special rain gauge has been designed at this Station. The two general requirements to be met in making this gauge accurate and workable for the purpose were: (1) prevention of absorption of sulfur in gaseous form from the air, and (2) effective functioning in both winter and summer.

[1] Journal Paper No. 294, Purdue University Agricultural Experiment Station. Contribution from the Department of Agronomy. Project supported in part by funds of the Texas Gulf Sulfur Company.

Alway (*1*) has shown that certain metals, when used as the collecting vessel, might absorb considerable sulfide from gaseous form in the atmosphere. Of the common construction metals, aluminum is the only one which does not form an insoluble sulfide in air, and this metal was therefore selected as the basic material for the gauge.

The second requirement entailed the collection of a representative catch of rain and snow in winter, at the same time avoiding damage to the apparatus due to freezing. This problem was met by constructing a well-insulated gauge, with storage container below frost line. A cross-sectional sketch is shown in Fig. 1. Once the gauge is installed, the water is

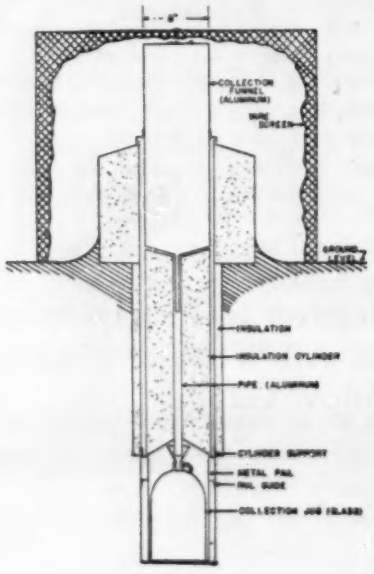


FIG. 1

collected in an ordinary 1-gallon jug placed inside an insulated waterproof cylinder (well), which is sunk below the frost line. The dismantled unit is shown in Fig. 2.

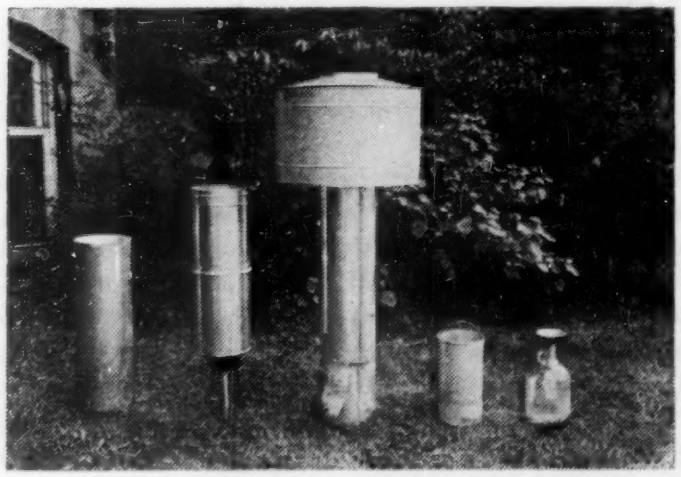


FIG. 2

Insulation (Fig. 1) to make the well arrangement an effective protection against freezing involved: (a) an insulation cylinder of glass wool, 28 inches long, separating the collection funnel from the gallon jug. A 1-inch aluminum pipe extends through the insulation cylinder from the collecting funnel to the small funnel in the jug; (b) a cylinder of 5 inches of glass wool around the exterior of the above-ground portion of the well; (c) a cylinder of 1 inch of glass wool around the below-ground portion of the well; and (d) a coat of lamp black on the exterior of the above-ground parts to absorb all possible heat from the sun in the winter. At the 3-foot level in the ground (depth of the middle of the jug), although the temperature varied between 26° and 41°F. at Lafayette, Indiana, during the period February 11–20, 1947, neither the gauge nor the contents were damaged. This suggests the advisability of thicker insulation and deeper placement in colder regions.

The gauge is relatively easy to manipulate, since only three units need to be handled in order to reach the collected water (solution). After the collecting funnel is removed, the insulation cylinder is drawn out, and finally, an iron rod is used to hook the pail containing the collection jug. The pail is used as a precautionary measure, a safety factor if the jug breaks. The gallon jug is large enough to hold 5.4 inches of rain, which is more than the average monthly rainfall in this area. In the event of heavy rains it is changed as often as may be required.

Farmer cooperators who operate the gauge regularly send the jug containing the solution to the Station for analysis. When snow collects in the funnel and is not melted by the heat of the sun or increase in air temperature, the farmer operator removes the funnel and the collecting bottle to the house, covers the funnel, sets it on a suitable stand, and the snow is melted into the jug. The collecting funnel stem fits into the smaller funnel, thus preventing any loss during melting.

In choosing the site for the gauge, it was considered important to take cognizance of the variable sulfur content of the air as affected by external conditions. Volk, Tidmore, and Meadows (*4*) reported a variation of from 7.23 pounds SO_3/acre annually at Kinston, Alabama, a rural area, to 76.79 pounds SO_3/acre near Birmingham, Alabama, an industrial area. Thus, sulfur deficiency would be expected in the former area but not in the latter. Four major factors were considered in choosing a site: (1) proximity to an industrial area; (2) proximity to a railroad; (3) direction of prevailing winds in relation to the sources of smoke; and (4) careful selection of site in order to catch a good sample of the rainfall representative of the conditions selected, considering the three foregoing factors. Ideally, the gauge should be placed in a clearing within a forested area (especially for snow collection). Since this requirement could seldom be met, it was concluded that meeting the following requirements would insure relatively representative sampling. The first three items are those set forth by O. E. Hays, of the Soil Conservation Service, in a communication to one of us (M. L. J.) in October 1944.

(1) The site should be nearly level and protected from grazing stock.

(2) Any area which suggests localized differential wind conditions should be avoided.

(3) Exposure from the sky must not be obscured; as a working rule the gauge is set at least twice as far from any obstructing object as the obstructing object is high.

(4) As suggested in 1945 by N. J. Volk, a wire screen, placed around, and slightly higher than the gauge (Fig. 1), will prevent contamination by bird perching, since birds tend to light on the screen in preference to the gauge. The screen will also serve as a windbreak.

References

1. ALWAY, F. J., MARSH, A. W., and METHLEY, W. J. *Soil Sci. Soc. Amer. Proc.*, 1935, **2**, 229.
2. HARTE, R. A., and TRAVERS, J. J. *Science*, 1947, **105**, 15; ELMAN, R., *et al. J. Amer. med. Ass.*, 1945, April, May, June. (Council on Foods and Nutrition Monograph.)
3. LIPMAN, J. G., and CONYBEARE, A. B. *N. J. agric. exp. Sta. Bull. 607*, 1936.
4. VOLK, N. J., TIDMORE, J. N., and MEADOWS, D. T. *Soil Sci.*, 1945, **60**, 427–435.

Book Reviews

Encyclopedia of endocrinology. Section IV: ***The ovary***; Vol. VII: ***Ovarian tumors.*** Hans Selye. Montreal: Richardson, Bond and Wright, 1946. Pp. vi + 289; Bibliography: Pp. 427. $21.75.

In this two-part volume, which forms Section IV of a contemplated 10-section treatise, Dr. Selye has undertaken an experiment designed to demonstrate the practicability of preparing, as he expresses it, a rational classification and evaluation of all publications pertinent to a large field of medicine. In this instance consideration is given to ovarian tumors as part of the field of endocrinology.

In his interesting foreword the author reveals the realistic and generally unexpressed suspicion that some of the very heavily financed investigative efforts now in progress are, in many instances, of the leaf-raking variety, probably more productive of voluminous reports by job-maintaining, time-killing researchers than they are indicative of that critical and spontaneously sustained avid scientific interest possessed by so few.

The text is divided into 10 sections, each marked by a marginal thumb index. The general plan for each section, or chapter, is similar. The author first gives literary references to general reviews, in the various languages, covering the subject matter. These are followed by a definition of material under consideration, a brief history of the subject, a classification, a discussion of the pathologic anatomy, chemical considerations where indicated, incidence, pathogenesis, clinical course, complications, diagnosis, prognosis, and therapy.

The last five subheadings arouse this reviewer's curiosity, for they are concerned primarily with clinical considerations, and the author, although a doctor of medicine, is not a clinician. It has therefore proved interesting to see how these subjects are treated by one whose efforts have been confined principally to the preclinical phases of medicine. It is apparent that the author's lack of experience in the clinical arena at times deprives the text of a much-needed critical clinical evaluation.

The first chapter is devoted to a general discussion of ovarian tumors. Obviously, the author's first task is to define what he means by an ovarian tumor. This, it must be conceded, he has not done. He states (p. 2) that the transplantation theory of endometriosis is now generally accepted. It is doubtful, however, whether this general acceptance exists. Ten different classifications of ovarian tumors, including one of the author's are given. Dr. Selye's own classification does nothing to assuage the general unsatisfactory prolixity that clouds the subject.

It is stated (pp. 2 and 3) that folliculomas and Brenner tumors have been known to cause virilization. The reviewer finds it difficult to accept such a flat, unqualified statement in a field where the utmost reserve is essential.

The author states (p. 15) that ovarian neoplasms, such as folliculomas, and particularly follicle cysts, which secrete an excess of folliculoid material may, therefore, be oncogenic and produce primary tumor formation in another organ. This statement has an uncomparable experimental basis and not more than questionable clinical support.

The discussion of the use of ovarian tissue for biopsy in the course of an operation as a guide to conservative or radical surgery (p. 23) would be more helpful to the general reader if it were distinctly emphasized that where the tumor is single and can be completely delivered and removed, material for biopsy should be obtained after such removal. This would avoid spilling material from an unsuspected cancer cyst or a mucinoid tumor into the peritoneal cavity. Under differential diagnosis the author fails to mention corpus luteum persistans and the occasional large, simple, follicular cyst, which produce clinical tumors whose character can only be suspected and which, under observation, generally disappear permanently.

Para-ovarian tumors are interestingly and well discussed in the second chapter.

Endocrine tumors comprise the next section. Follicle cysts are first discussed. The author apparently believes that so-called cystic ovaries that may occur after hysterectomy, salpingectomy, etc., are invariably due to disturbances in formation of the gonadotropic hormone. The fact that interference with the ovarian circulation may be the principal factor in most instances, due largely to the surgical technic employed is not considered.

In discussing "metropathia hemorrhagica" (p. 39), Dr. Selye considers inclusion of abnormal uterine bleeding appropriate because this is the most important clinical manifestation of cystic ovaries, while the principal associated uterine endometrial change is a benign glandular hyperplasia. The issue is patently confused by considering that endometrial hyperplasia is always present and therefore synonymous with metropathia hemorrhagica. Certainly in the reviewer's experience, critical study of abnormal uterine bleeding of the so-called dysfunctional type is by no means generally associated with endometrial hyperplasia. More often the picture is that of a proliferative, nonsecretory endometrium. Occasionally an unmistakable premenstrual secretory change is observed. It is regrettable that a problem which has begun to show some clarification in modern texts is again rendered confusing and misleading to the reader.

Under differential diagnosis of metropathia hemorrhagica (p. 43) the highly debatable statement is made that this abnormal bleeding state is not likely to be confused with cervical cancer, because cervical cancers *are palpable and visible at an early stage of their development* (italics the reviewer's).

The author states unqualifiedly (p. 51) that the folliculoma (generic term for granulosa cell tumor) is a tumor of the ovarian follicle. To the tyro this will prove a misleading statement and one which, because of its simplicity, he unfortunately is likely to remember.

The section on corpus luteum cyst leaves much to be desired. One may well question whether Fig. 3, plate 11, is a corpus luteum cyst, as designated, rather than a normal large cystic

corpus luteum. A good discussion of lipid cell tumors follows. The author also discourses interestingly on so-called testoid hyperthecosis. However, when he states that ovariectomy must be the treatment for this ill-defined state (p. 74), one may well question the wisdom of his recommendation.

Under tubular adenomas there is a good discussion of the tumors commonly referred to as arrhenoblastomas. Also included are the small, not uncommon, so-called rete adenomas. The author's logically presented reasons for the term tubular adenomas fail, however, when he includes those tumors which show no identifiable tubular elements but are associated with virilizing phenomena.

The heading "Ovarian Common Cysts," as used (p. 98), is confusing, because the discussion actually concerns cystic neoplasms, *i.e.* cystomas.

The sections on endometriosis and teratoid tumors are excellent. It would have been helpful, however, if the author, in discussing dermoid cysts, had more fully evaluated the relative importance or unimportance of X-ray studies in their diagnosis (p. 235). It is also confusing to note so many illustrations labeled as "dysembryoma," since the term is hardly utilized in the body of the text.

The final section is given over to nonepithelial ovarian tumors.

The illustrations throughout the text vary from indifferent to excellent. A 60-page list of periodicals which concludes this volume might well be included in the bibliographic volume in future editions.

KARL H. MARTZLOFF
808 Medical Dental Building, Portland, Oregon

Musical acoustics. (2nd ed.) Charles A. Culver. Philadelphia: Blakiston, 1947. Pp xiv + 215. (Illustrated.) $3.00.

At the recent meetings of the Acoustical Society in New York physicists and engineers mapped grand strategy for a peaceful invasion of the field of music. Prof. Culver's book constitutes somewhat of an insurance policy to future generations of musicians that the invasion will remain a peaceful one; or, if this invasion should prove less peaceful than advertised, it guarantees to those musicians who will study it that they will at least be able to understand the language in which the peace treaty may be written.

Musical acoustics is a useful and readable book for those interested in the physics of music. It should also bring reading enjoyment to a much wider audience. It should prove most valuable, however, as a text in a one-semester course for music majors. The book is written at a level appropriate to the usual background and needs of such students.

An introduction to certain general principles of acoustics is followed by chapters on hearing, pitch, and quality. From there we go to a discussion of somewhat more technical topics such as musical intervals, temperament, consonance, and dissonance. The author never tries to draw up a musical code or to arrive at aesthetic judgments on the basis of cabalistic juggleries; on the contrary, he invites the reader "to maintain an open mind with regard to the possible adoption of new forms of tonal expression."

The second half of the book is given over largely to a comprehensive treatment of the production of musical sounds by the more important instruments. Here we find a wealth of oscillograms and sound spectrograms, many of which have been taken by the author himself. Prof. Culver's own contributions to experimentation in this field—the harmonic analyzer for unsteady musical sounds and the Synthephone, which produces entirely new musical sounds—find their natural place in these surroundings. In the last part we find a chapter on "The Acoustics of Rooms," followed by a rather brief chapter on "Electronic Musical Instruments."

In this second edition Prof. Culver concludes with a discussion on the recording and reproduction of music. Beyond this substantial addition there are entirely new sections on the Doppler effect and transients and an enlargement of the section on vocal organs and the voice.

In the spirit of constructive criticism, which Prof. Culver invites, this reviewer would like to make two minor points. It should be possible to replace many of the oscillograms by more distinct ones. Some progress in this direction has been made in this edition, but there is room for more. Also, nowhere in the book do we find a discussion of auditory masking, though its importance for composers and orchestrators can hardly be overlooked.

All in all, Prof. Culver's book points the way toward a more sympathetic cooperation between the scientist and the musician in their very pleasant task of making man's life richer and more beautiful.

WALTER A. ROSENBLITH
Psycho-Acoustic Laboratory, Harvard University

Russian-English technical and chemical dictionary. Ludmilla Ignatiev Callaham. New York: John Wiley, 1947. Pp. xvii + 794. $10.00.

It is to be regretted that this dictionary was not made available some five or six years ago, when the need for such a book was very urgent. It is more than a chemical dictionary, for it includes a fairly complete coverage of mineralogy, metallurgy, mining and geology, general engineering, machinery and mechanics, electrical engineering, pharmacy, and botany, as well as other pure and applied sciences.

The book is generally well done and contains less than the expected number of deficiencies for a first edition. A number of possible meanings provided for each Russian word may be considered as adequate. The lesser deficiencies may be typified by the translation of "АЛОСТЪ," which is really a state of redness rather than "ruby color." The translations of a number of compounds in the phosphorus family do not conform to the accepted nomenclature and may be misleading; thus, "ФОСФИНИСТАЯ К." should be -phosphonous acid, and "ФОСФИНОВАЯ К." should be -phosphonic acid. The reviewer feels that the inclusion of the letters of the old orthography should have been permitted because of the existence of a considerable amount of pre-Soviet literature. This is compensated for, however, by a number of highly desirable features: translations of numerous abbreviations, a listing of word endings, and a good coverage of idiomatic phrases.

Although the appearance and legibility of the book are very good, one would expect a more durable binding for a book of this size (and price) than the "flexible" one provided. A thumb index should also have been provided to facilitate the use of the book by persons not fluently familiar with the Russian alphabet.

G. M. KOSOLAPOFF
Monsanto Chemical Company, Dayton, Ohio